EDITORIAL

THE New Year is poking its head over the horizon, and for most people in the radio trade it will be a TV year. With all stations on the air the public will begin to make up its mind what it is going to do about it.

It may not be very fair to draw conclusions from what has been seen to date, but at least it is evident that there is no mad rush on anyone's part to have TV at any price because it is so good.

The initial programmes, despite one's admiration for the initiative shown in getting on the air quickly, haven't done very much so far to advance the cause.

On the contrary, they have persuaded many to wait for something better before signing on the dotted line.

We are unfortunate in that the Olympic Games — an event which could have provided a great impetus for sales — came at a time when there were only a few receivers about, and no facilities for joining Sydney and Melbourne with direct TV links. Had they been held twelve months from now, the story could have been very different.

In Melbourne the Games have undoubtedly proved a substantial drawcard, but nobody is organised to take advantage of the situation.

I am certain, too, that more people are waiting for larger screens. I have heard customers in radio shops say that they would be back when more makers had 21-inch sets to offer.

And they will, too, probably within the first three months of 1957. I will be most surprised if every well-known brand has not announced additional models by next April.

Then it was confidently predicted that many sales would be made so that their owners could "keep up with the Joneses." I doubt whether this will ever be an important reason why the average Australian will buy TV.

He is much more likely to commiserate with the Joneses about the high cost of sets.

I think it is only being realistic to forecast that, during the next twelve months, TV's progress will be steady rather than spectacular. The public will be the jury during that time, and it would be wise for TV interests to get together, and make sure that at all costs they will have more than routine programmes borrowed from radio, and American crime films, to fill their star billings.

It isn't good to hear members of Parliament asking questions in the House about the poor quality of TV material on the air.

For, as I have pointed out several times, it is the programme content which will count most when the public balances its budget, and decides whether TV is for them now or "in another year or two."

A Merry Xmas to you all. If this first TV Xmas comes to only a few, I am quite certain that it is but a prelude to many happy Yuletides ahead.

John Moyle

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RADIO ★★ TELEVISION AND HOBBIES

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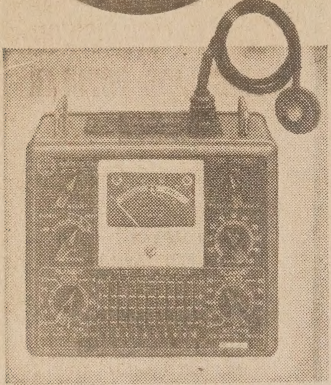

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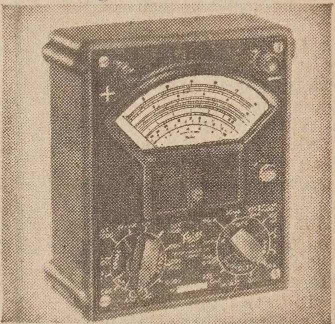

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MX47	Multimeter (20,000 Ohms/Volt)	£39 15 0
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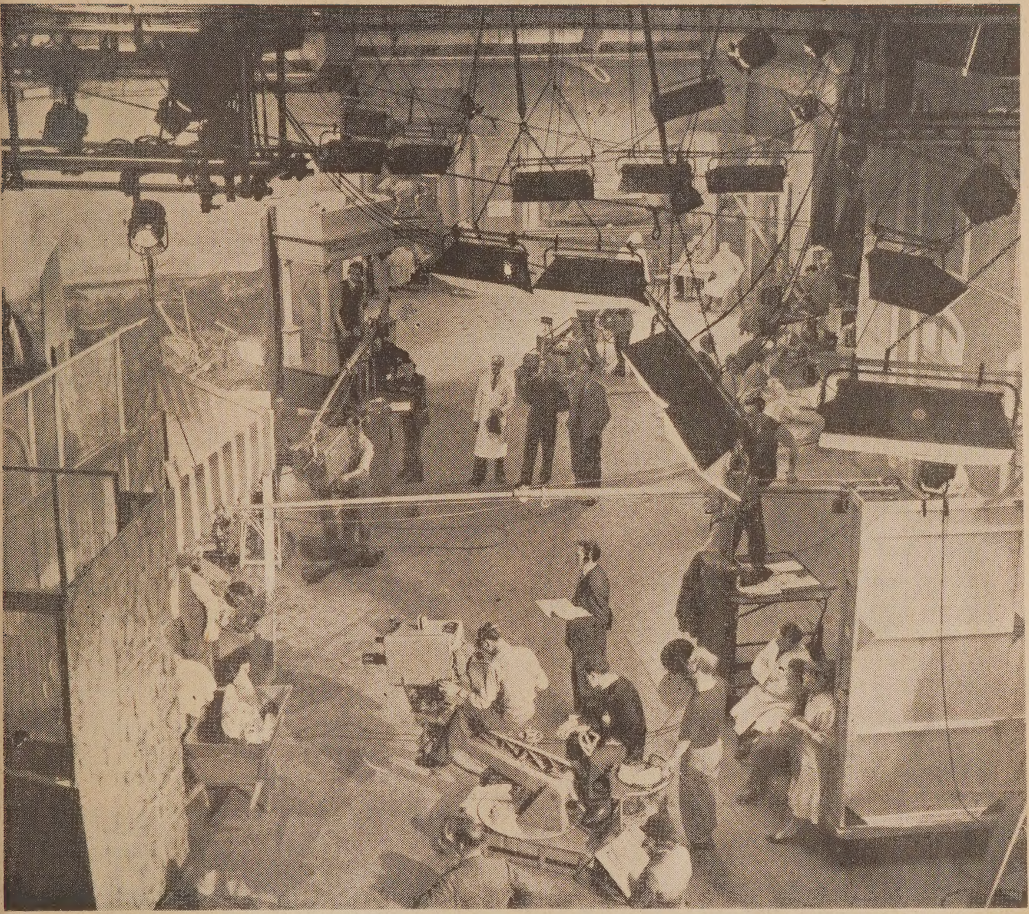
AUSTRALIA'S NEW ERA WITH TV



TELEVISION IS HERE AT LAST! After so many years of being "just around the corner", TV this month at last comes officially into Australian homes. From now on life will be different, spiced with a new adventure filled with a new interest, enlightened, we hope, with a new and powerful influence for the community's good.

THIS fine picture, taken in the studios of the BBC, vividly illustrates the alert action that goes to make a first-class studio program of the type we soon hope to see in Australia.

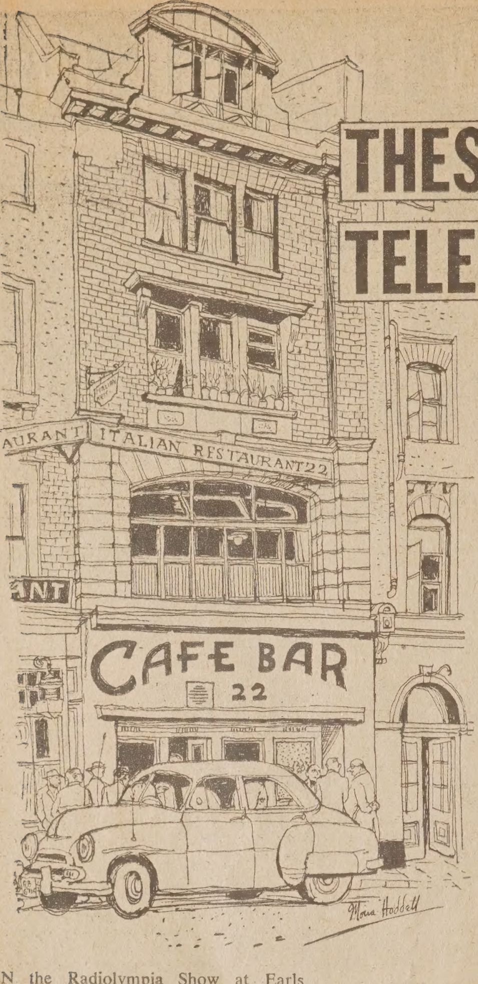
The set, a simple farm scene, is at the left, voices being picked up by the long sound boom from overhead — no shadows please! Above and around are the mobile lights carefully pre-checked for best picture moulding. In the foreground a camera has been moved for the close-up; just beyond it, another waits its cue to come in. Camera operators watch their picture and listen for instructions through their headphones, all wear soft shoes. The director with his script has a VHF radio receiver strapped to his back, so that he can hear the producer's voice from the control booth without bothering about connecting wires.

In the background other sets are waiting, perhaps even for this show; technicians and actors are silent, watching the action. This is Studio G, second largest at Lime Grove, with a floor area of over 3500 square feet, completely soundproofed and air-conditioned to cope with the hundreds of kilowatts of lighting power. Four cameras can be used for a single production.

It may be some time before Australian studios are as elaborate as this one, but we will see by means of film many scenes acted out in it. From now on, TV will bring the world into your own home.

THESE MEN MADE TELEVISION HISTORY

The official opening of TV stations in Australia marks the commencement of a new era in home entertainment. At this time we should remember the work done by some of the TV pioneers, particularly that of Baird, who after a life of hard work, dissappointment, and successes, did not live to see many of his hopes and prophecies fulfilled. "Let us now praise famous men."



In the attic of this building in Frith Street Soho, London, John Logie Baird gave his first demonstration of TV in 1922. The outside wall now carries a plaque commemorating this historic event.

In the Radiolympia Show at Earls Court, London, the General Electric Company exhibited a pocket size television set with a 2in screen. A milling crowd craned their necks to watch it in action. They were fascinated by the diminutive unit and heaped high praise on the technicians who made such an electronic novelty possible.

But what of the men who laid bare the bones of television, making possible the transmission of pictures across space? Their praise remained unsung. Few people even knew that a 21-year-old student invented television 72 years ago.

Paul Nipkow was a German. He designed and built a device for flinging vision across distances which eventually became the basis of modern television techniques.

His story goes back to 1884 when Nipkow was granted Patent No. 30105 for a system of "conveying the illusion of motion over wires with electricity". His invention was no idle novelty; the principles laid down were the basis of all television units up till 1930, when electronic advantages bridged the gaps which had limited and finally defeated the earlier experiments.

Nipkow was familiar with the basic principles of cinematography. He knew that the illusion of motion can be created if a succession of images are brought to the eye at least 16 times a second. It was therefore necessary to devise an electrical transmitter which could do just that.

He also knew what a strange metal called selenium could be made to turn a picture from a visual manifestation to an electrical impulse.

Selenium, with its curious properties, was first noticed by an English scientist named Willoughby Smith. While experimenting with the metal, he noticed that its ability to conduct electricity varied from time to time. Further investigation showed that selenium was sensitive to light. In an ill-lit room, for instance, its conductivity was very poor, but as the brightness of the room increased, so also did the conductivity of the metal.

Paul Nipkow was probably the first man to attach any significance to this discovery. He carried out some independent tests and realised that the conductivity of selenium varied directly with the amount of light falling on it.

"Here," he may have told himself, "we have an electric eye."

Obviously, if an electric current was passed through the metal and the amount of light striking it changed continuously, the voltage of the current would rise and fall in intensity. Nipkow realised that it was a possible means of turning vision into electrical impulses.

Unfortunately, a selenium cell could only detect light or darkness. If an entire picture fell on it, the cell could not detect the patches of light on darkness and shade. It merely would receive the jumbled mass of light and send it on as an electrical impulse.

How could Nipkow unscramble it?

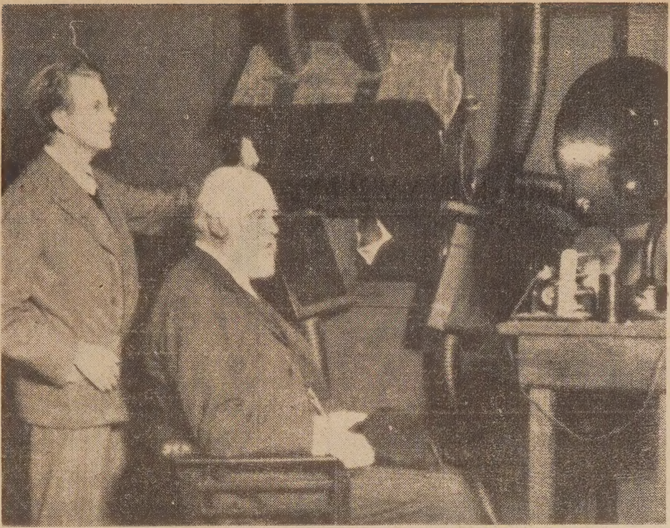
He didn't even try. Instead, he devised an ingenious gadget which would let each tiny portion of the picture tell its own story, whether it was a light patch or a dark one.

Nipkow devised a scanning disc which remained the basis of all television scanning equipment until 1928, when electronic apparatus took over. His reasoning went something like this:

We cannot transmit an entire picture because that means scrambling and unscrambling a mixture of light, darkness and shade. If transmission is to be practical, we must break the picture up into thousands of tiny parts, each one either light or dark, just as a newspaper photograph consists of hundreds of dots of ink which together make black and white.

What is more, we must do this sixteen times every second and transmit each part individually, so that an illusion of motion is maintained.

Nowadays, the process of breaking a picture up is called "scanning", but Nipkow called it searching. He searched his pictures by drilling a small hole in a piece of metal and allowing a beam of light to pass through. The hole is placed so that it falls on the top left hand side of the picture or scene to be transmitted. Then it is moved along a distance equal to its own diameter and "searches" the next area of picture before moving again. At the end of the line, the hole is lowered slightly and it proceeds to scan the second line. This process goes on until the whole picture has been scanned from top to bottom and each tiny portion has made its impression on the selenium cell, altering the voltage of the current passing through.



Sir Oliver Lodge inspects one of Baird's early transmitters in 1927. At this time Baird was experimenting with "nocto-vision", or night TV using infra-red radiation. All Baird's early equipment was made using mechanical picture-scanning methods. The develpoment by EMI of electronic scanning, and the adoption of this system by the BBC, sounded the death knell to many of Baird's hopes.

NIPKOW'S SOLUTION

To cover an entire picture this way would obviously be a long and tedious process. To do it sixteen times every second would be a mechanised impossibility.

Nipkow solved the difficulty with a brilliant stroke of ingenuity. He produced a circular disc which would be revolved before the picture to be transmitted. The disc had a series of holes arranged in a spiral. Between each hole, in both the circular and the off set direction, was a space as wide as the diameter of the hole. Provided that the size of the picture was small enough not to overlap the disc, it could be scanned by spinning the disc around once.

PHOTO-ELECTRIC CELL

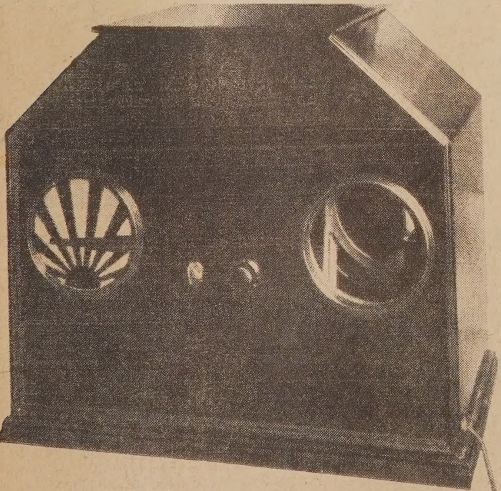
What could be more simple than to turn the disc around 16 times a second and create motion?

Once Nipkow had unscrambled his picture in this way, he would merely need to transmit it to an identical disc placed in the receiving apparatus to obtain his television. Making the other disc was no problem, but Nipkow never succeeded in synchronising the two speeds. It was not until 30 years later that another inventor perfected synchronisation.

Nipkow, as we have seen, proposed to link the two scanning discs with his selenium cell. Here again he found an insurmountable barrier. The "electric eye" was too reluctant to keep pace with the disc. It was not sufficiently sensitive to light changes to record each patch of light the disc revealed. Despite all efforts to speed it up, the selenium metal continued to take its own sweet time.

Nipkow never quite got over this problem and he was not able to faithfully reproduce either stationary or moving scenes.

In modern TV sets, the place of the selenium metal has been taken by the photo-electric cell, which can give incredibly rapid response to the smallest of light changes.



An early form of Baird set known in the trade as Jumbo. It used the then universal spinning disc for vision reception.

Nipkow did not have the advantage of another modern technique, which curiously enough was planned by a fellow German 30 years before the TV experiments began.

Obviously, Nipkow needed some kind of light which would rise and fall in intensity rapidly enough to follow the spiral pattern traced by the scanning disc. Although he never found one, such a light was ironically already begging to be used and available just around the corner.

Professor Giessler was an old man when Nipkow was a boy. In 1854 he discovered a special form of light which eventually led to the perfection of TV.

GIESSLER TUBES

One of the professor's favorite experiments was to place a pair of metal electrodes in a glass tube, evacuate the air as far as possible and then seal in its place one of the many gases that chemistry has produced. He fired a high tension electric charge through the tube and watched the result.

Each gas gave off a characteristic glow as the current went through. The color depended on the nature of the gas, but it remained constant for each. The colors became known as the spectrum of the gas and the apparatus as "Giessler Tubes".

Years later in 1890, Lord Raleigh—an English physicist—discovered a new gas in the atmosphere and he called it neon. When placed in a Giessler tube it gave off a characteristic pink spectrum.

The discovery was directly responsible for the blaze of neon lighting which illuminates all our main streets. But it was also the first source of illumination for TV receivers.

If a Giessler neon tube is made up with a square plate as the central electrode and placed in an electric circuit, the plate will be covered with a steady pink-red glow which remains even and uniform as long as the voltage is steady. If it drops, however, the glow will be dimmer. If the voltage rises, the glow will brighten, and it could be varied between full brilliancy and total darkness as many as 100,000 times a second.

It is therefore a "plastic" source of light.

A neon tube of this type, when placed in a circuit with a selenium cell, will display the picture in two shades of pink on the central tube.

To understand this, let us consider the disc as being stationary for a

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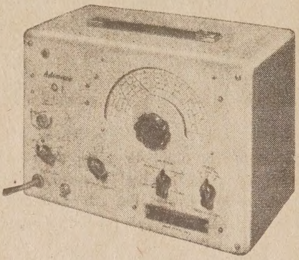

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SALES AND SHOWROOMS, 477 KENT STREET, SYDNEY moment with one of its scanning holes resting on a spot opposite the picture to be transmitted. The neon tube in the distant receiver will glow more or less brightly, according to the voltage. Should the spot be a black one, the tube won't glow at all.

Of course, the observer does not see that the plate is dark because the human eye is not equipped to record such brief glimpses of time. Instead, it sees the general light pattern revealed as the plate moves from high to low intensity under the influence of the scanning disc.

The first man to successfully build apparatus along these lines and to transmit the image by radio, not wires, was John Logie Baird, a dour man who lived alone and worked alone without a penny to his name.

Baird knew all about Nipkow's experiments and he based his early apparatus on the 1884 principles, except that he used several photo-electric cells to do the job of the selenium block.

He was short of friends, short of money and short of apparatus. Perhaps it was stubbornness, possibly confidence which made him word an advertisement in the personal column of The Times, late in 1923, thus:

> "The inventor of a device for transmitting pictures by radio requires assistance (not financial) for the making of the apparatus . . ."

LONE WORKER

Apparently there was little response to the plea, for Baird continued to work alone in his tiny workshop over a florist's shop at the seaside resort of Hastings. His apparatus was crude. The scanning equipment, for instance, consisted of an old tea chest, a tin biscuit box—to serve as a lamp holder—some cheap bull's eye lenses, a metal disc and a tiny electric motor.

Even with this equipment, he made modern television a reality in 1924 by transmitting a blurred image of a maltese cross across a few feet. The transmitter and receiving apparatus were placed side by side, for that was the limiting distance.

Even as late as 1928, Baird was still using Nipkow's scanning disc as the basis of his apparatus. Yet that year a group of enthusiasts in New York saw the face of Mrs. Mia Howe flash on to a screen. Baird in England had thrown his radio pictures across the Atlantic!

"The inventor of a device for transmitting pictures by radio requires assistance (not financial) for the making of the apparatus"—

—But there was little response.

MIRROR DRUM

By 1931, the British inventor had perfected his "mirror drum" technique for scanning the scene and in 1938 he demonstrated that the picture size problem could be solved by projecting the image from the kinescope on to a fluorescent screen. In that same year, he also triumphantly announced a successful system of color television.

Unfortunately, like many other inventors, Baird never reaped any rewards from his labors, but he lived long enough to see the supreme success of television as a medium of entertainment.

For the basis of the television sets which will soon be in Australian homes, we switch this story to America.

A young man named Philo Farnsworth had also heard of Nipkow's experiments and was seeking a way to overcome his limitations long before news of Baird's success swept the continent.

Like Nipkow, Farnsworth was a student when he first dreamed of a formula to fling pictures across space. He was 16 years old at the time and living in the ranch town of Rigby, Idaho.

Vladimir Zworykin, now Vice-President and Technical Consultant of RCA Laboratories holds the iconoscope, TV's first electronic eye which he invented.

One day he went to his school superintendent, Mr. Justin Tolman, and asked if he could have special tuition in science. He said that he wanted to be an inventor.

Later, in a dramatic patents case conducted by the Washington Patents Office, Tolman swore that the boy absorbed every scrap of information that went his way. He soon outstripped the normal curriculum and continued studies far beyond school level.

One afternoon, Tolman found the study blackboard chalked from border to border with electrical circuit diagrams. Farnsworth was feverishly scrawling the finishing touches when the master walked in.

"I told you I wanted to be an inventor," explained the youth. "I've got to tell you about it, because you are the only one I can make sense to."

He later explained that his idea was the continuation of some experiments he had read about in a science magazine. Only there was a difference, in place of the rotating disc method described, Farnsworth had devised a diagram for an electric "image dissector", as he called it.

In the following spring, Farnsworth and his family moved out of the neighborhood and he lost contact with his tutor. But the lad did not forget his schoolday theories. In 1926, he was working as an office boy in Salt Lake City and his willingness brought him to the attention of the manager, George Everson.

Inevitably, the conversation led to television. Everson was greatly impressed, not by the boy's theories, which were way above him, but by the complete change in Farnsworth when he talked about his favorite subject.

Everson took him to San Francisco to get a hearing before men who could evaluate the strange theories. They were so impressed that they formed a syndicate and backed him with 25,000 dollars—a lot of money to stake on a 20-year-old's dream.

In his new laboratory, Farnsworth came to grips with the practical sides of the problem. He was soon bombarding the US patents office with fresh ideas.

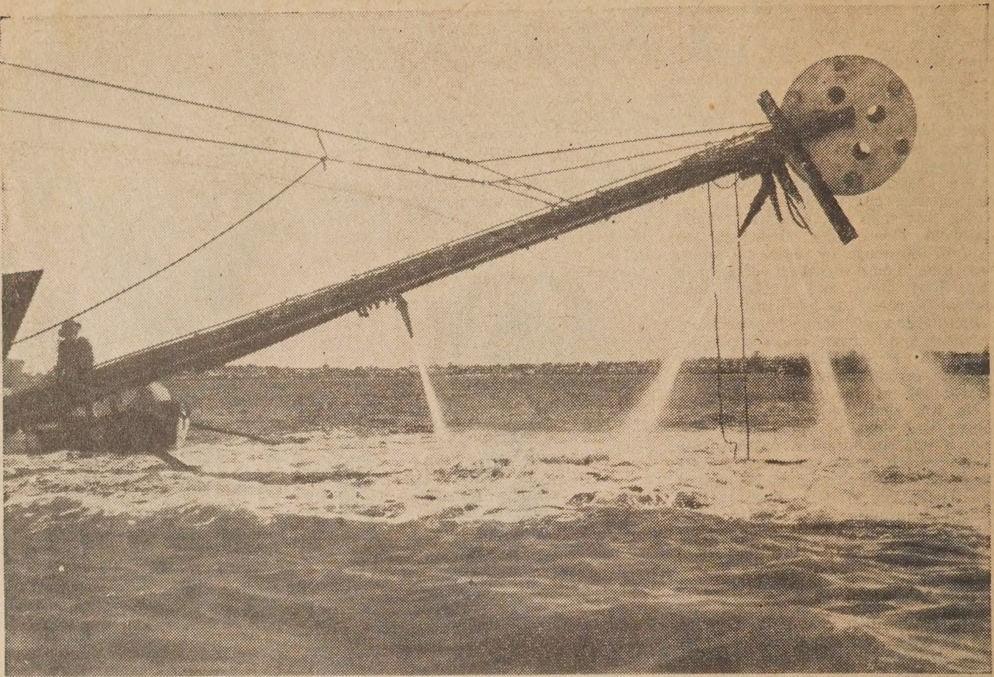
ZWORYKIN

Meanwhile, another American was duplicating Baird's achievements and also experimenting with electronic scanners. He was an immigrant employee in the vast research laboratories of the Westinghouse Corporation.

Vladimir Zworykin vainly tried to get permission to work on some ideas which he claimed had been formulated when as a young man he had been working for a European experimenter in television.

After a while he took his ideas to another firm and eventually came to

(Continued on Page 79)



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**Epikote*

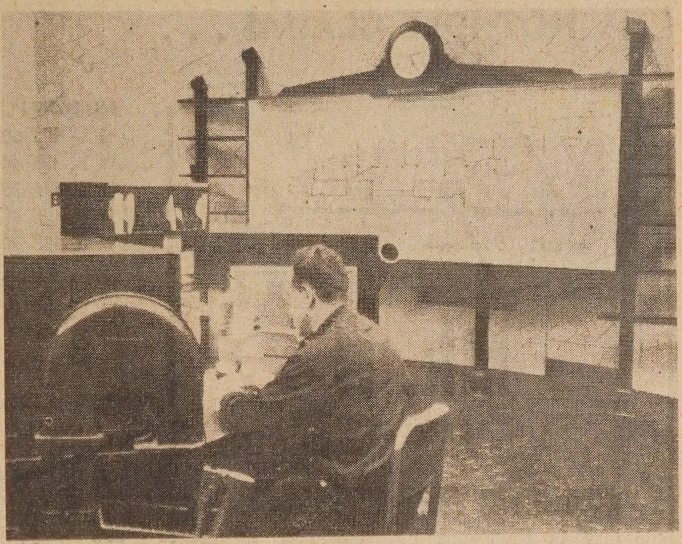
Laying cable under the Coomera River, Q'land.

THE N.Y. POLICE RADIO CENTRE

The New York Police Department is perhaps the largest and most active in the world, sharing with Scotland Yard the fame of fiction and of fact. The efficiency of the Department leans very heavily upon its network of radio communications which apart from covering activities within local precincts, has its connecting links far beyond the boundaries of Manhattan.

BY THE EDITOR

THE New York patrol car has a glamor all of its own, much of it built up via Hollywood, no doubt, but thoroughly deserved for all that. Every crime play or murder mystery produced in America seems sooner or later to feature a posse of "cops" screaming to a stop at the scene of the trouble with sirens blaring, or remorselessly drawing the net of Nemesis around evil-doers under the guidance of the ominous voice "calling all cars".



A radio operator in contact with one of New York's two radio controlled sections. A pneumatic message tube is at his left—a large map of Manhattan Island at the rear.

One of the famous N.Y. police cars has equipment on the rear cabin floor to avoid the heat of the luggage compartment.

In common with most radio-minded people, I had the urge while in New York to see if I could take a ride in one of these cars—even without the sirens and the gun-duels—and so see in action the system which binds the whole organisation together.

So I sent in a request through the appropriate channels and hoped for the best.

I learned afterwards that my request found its way into all kinds of places for a check on my security risk and general bona fides before a courteous reply was received inviting me to call upon Assistant-Chief Inspector Burns, who is in charge of communications at New York Police Headquarters.

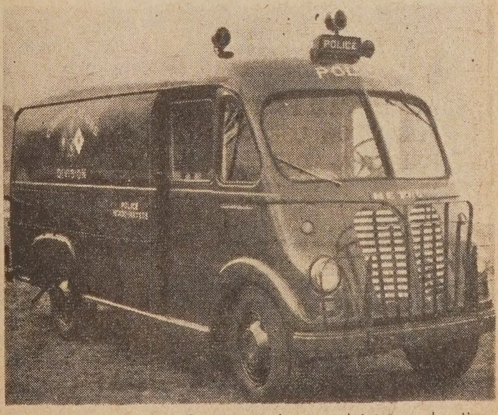
I found him a very tall, likeable man, deeply versed in the art of radio message handling, ready to show me how everything was done, within the ambit of radio and out of it.

Like all senior American police officers, he takes a keen interest in educating people, particularly young people, in the ways of decent citizenship. On the wall behind his desk were numerous citations and certificate awards from various bodies occupied in juvenile welfare and police club work. The New York "cop" is as tough and merciless as they come when the situation demands, but he has a very high sense of that community interest and mutual helpfulness which is so characteristic of the American people.

Behind the double ceiling-high security grilles, locked and guarded against unauthorised entry, he is boss of the radio nerve centre at the top of a domed building, some 50 years old, down near the tip of Manhattan, where the active life of the city flows at quick tempo.

Here in a spacious, well-lit hall are the switchboards, operating tables, wall maps and ordered activity which enable thousands of quick-fire messages to fly backwards and forwards without pause, day and night, from hundreds of points scattered throughout this immense city.

The vastness of the radio-controlled network is somewhat bewildering at first acquaintance. The job of keeping



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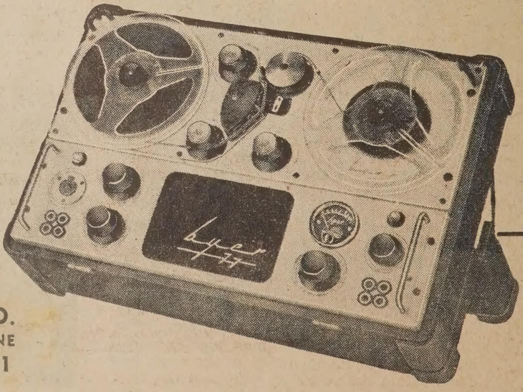

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General view of the control hall. The switchboard in the foreground controls the ambulance system which is part of the police radio network. At the rear is the general switchboard for internal communication, signal boxes, and radio calls to ships and from elsewhere in the country.

order among 14-million people, concentrated more highly perhaps than anywhere else in the world, might make the most courageous quail before its very size.

The figures I have are undoubtedly out of date already, but they give, as the number of radio-equipped vehicles in Manhattan, Brooklyn, Queens, Bronx and Richmond, 262 solo motor-cycles, 282 cruiser patrol cars, 596 patrol cars, 13 harbor patrol boats, 5 helicopters, and 30 or more other vehicles, such as ambulances, maintenance vehicles and so on.

AMBULANCE CONTROL

In addition to this huge total, the police department operates the entire ambulance radio system for New York, which means that every ambulance call comes into the radio centre, and is dealt with on the spot.

Any call which might require police attention—and there are many of these—is automatically routed to the appropriate channel, so that investigation can be commenced without delay.

There are two main transmitting points on the island, one at headquarters adjacent to the control-room, and the other remotely controlled from it, but situated in the lower half. The equipment operates on frequencies in the vicinity of 160 megacycles and uses FM, as do practically all American mobile systems.

Four operators, each accommodated in a quarter section of a central control table, handle the car traffic. Each has three listening channels, and a switchboard from which he can instantly make connections elsewhere in the building through a dial-type telephone.

SIGNAL TRAFFIC

Eight more operators are at the ambulance table, checking in calls, nominating hospitals to which the unfortunate patients may be directed, and passing on those cases in which police action may be needed.

Six more switch positions cater for the signal-box traffic through which routine patrol checks are received.

Several other tables are occupied by those whose job it is to sort out information received through these channels.

In the next room is the transmitting equipment which shares part of the load represented by the mobile police vehicle out on the job.

EQUIPMENT POSITION

A fair proportion of the car equipment used is of late design, and can be accommodated under the front dashboard. But most of the cars carry it, of all places, on the rear floor behind the front seat.

This position was selected for several reasons. The most important is that better heat dispersion is obtained as against a position in a virtually airtight boot. When cars normally carry only a couple of patrol men, they don't find the equipment cases get in their way. On the other hand, they frequently have to carry items in the car's boot, where space could be valuable.

A good deal of American FM equipment consumes considerable power, so that heat dispersal is quite a problem.

Loudspeakers are always fitted to police radio. The crew while listening has its hands free, and everyone in the car can hear messages.

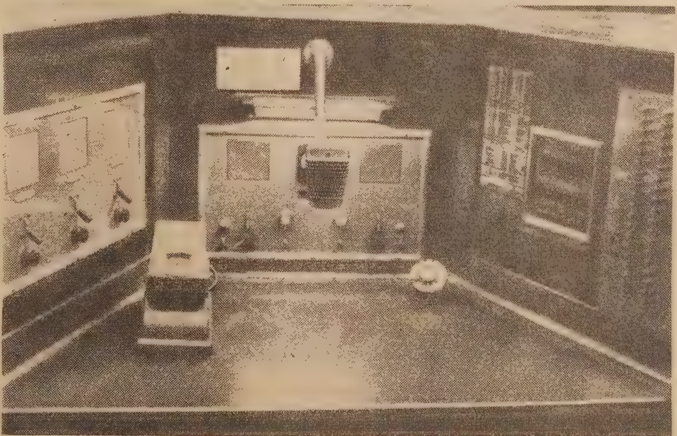
In contrast to Australia, motor-cycles are going out of favor for police work in USA, particularly in the New York area.

One disadvantage of cycle radio is that the rider must pull into the side of the road before he can answer a call.

CARS ARE BETTER

There is no particular problem in fitting them with equipment, but cars are comparatively cheap, and it has been found that a patrol car can operate for longer hours and under adverse weather conditions which would put a motorcycle off the road.

In New York, the exhausting summer climate is no time for motor-cycling,



Operating position at base station has 3 listening channels at left, twin transmitter controls and microphone at centre, and facilities for dialling incoming signals to appropriate points. In the foreground is a clock punching device for numbering and timing messages.

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Note Pickup heads are complete with diamond styli.

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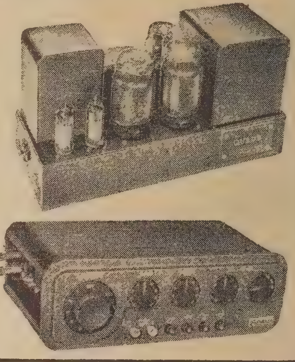

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and, in winter, the roads and streets are often covered with snow and sleet.

The radio equipment for motor-cycles is carried in two boxes, balanced each side of the machine, with a loudspeaker attached to the handlebars. The aerial is a flat plate mounted behind the saddle.

The policeman or patrolman on his beat is also required to keep in touch with the communications headquarters.

Scattered throughout the city are 2100 police call or signal boxes, and this number is being steadily increased. Every hour, each patrolman is expected to contact headquarters from one of these, to put in a report. In case of emergency such calls are connected through the switchboard to the officer required, otherwise the report is routine entered on the check sheets.

The public is also encouraged to use these signal boxes, and many such calls come in throughout the day and night.

Each box has a light which shines when headquarters want to call up the patrolman within whose beat it lies.

CALL SET

Another means of contact the patrolman has with his headquarters is through his own listening set.

This is a tiny super-regenerative receiver he carries with him. It is tuned to a transmitter which sends out a succession of numbers, each indicating a patrolman who is required to phone in through a signal box.

The numbers are initially recorded on a tape at the transmitter, and this tape continues to run through, repeating the numbers until, one by one, their owners take action. As this happens, the numbers are removed from the tape, to be replaced by others as they are required.

The police also use handie-talkie two-way sets operated by batteries, and mixing valves and transistors to give surprising efficiency and economy. These operate on their own channel to avoid interference with the main traffic.

On the waters of the East and Hudson rivers, which surround Manhattan Island, police boats keep constant control, and these, too, are connected to the radio system. So, too, are the Bell 47D1 helicopters, used for air observation of traffic jams, transport, and general observation work.

Further afield, police departments all over the country have their own short-wave radio transmitters by which they are able to keep constant contact with the exchange of reports and general liaison work. It is quite possible for the police, using their own radio system in co-operation with coast stations, to make contact with any ship at sea which may be within radio range.

The work of the communication department has a very long arm as well as a powerful, short punch!

MAINTENANCE

Maintenance where possible is carried out on the road by summoning a special van, fully equipped to make repairs and change-overs. A large number of maintenance calls can be quickly attended to, as it would be quite impracticable to have large numbers of cars doubling back to repair depots for assistance, apart from the fact that they would be off the road during that time.

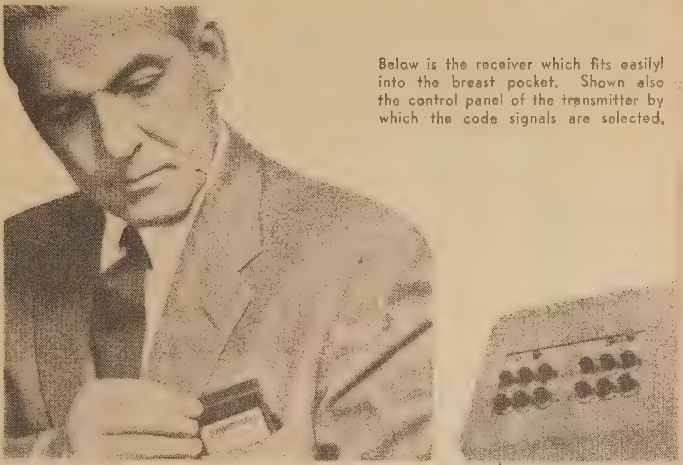
Badly-damaged units are brought back to the base for repair, where more than 25 mechanics work to keep them in order. More than 750 equipments are involved, which makes maintenance a very important matter.

After my tour of the radio centre, I had a look at several other technical departments at headquarters, including an elaborately-equipped photographic section which works overtime. Here, too, are the cells, line-ups, and offices where many disillusioned citizens on the wrong side of the law have gone through the checking-in routine. There wasn't much glamor about this part of the business.

The photographs included here were supplied from the New York police files by courtesy of Chief Burns, who later took me for a ride in a patrol car, and drove me back to my hotel.

Some others which I had hoped to include were, alas, lost in the camera I mislaid later in a New York taxi, and which all the available resources, radio included, were not able to restore to me!

PERSONAL PAGING---ANYWHERE



Below is the receiver which fits easily into the breast pocket. Shown also the control panel of the transmitter by which the code signals are selected.

This is the claim made for a new device released in America by the Stromberg-Carlson Company. It is, in fact, a small receiver, handy enough to be carried in the pocket, and which emits a clearly heard signal when its wearer is called from a central point.

THE system is the result of three years work by the company; who claim that it has solved a problem which so far has not been successfully met.

It provides instantaneous contact with its wearers over an area of several square miles. The receiver is only the size of a packet of cigarettes, and has no external wires or attachments.

It is quite silent until it picks up the correctly coded signal, on which it notifies the user when his, and only his, particular call is on the air.

A vast number of uses are seen for the device, which, according to its makers, will rapidly become indispensable wherever it is required to locate personnel quickly, and where conventional systems cannot be used.

Some of those applications are in hospitals, oil fields, construction projects, industrial plants, and other places where difficult internal communications problems exist.

HOW IT WORKS

In practice, someone will phone a factory, for instance, and ask for Mr. Jones, who may be anywhere on the premises. The switch-board operator by means of the pagemaster sends out on the air the signal which will operate the receiver which she knows Mr. Jones is wearing. The receiver responds by giving out a musical note, telling him that he is being paged. On hearing it, he phones the switchboard from the nearest point, and talks to his caller.

The system thus comprises an Encoder-Transmitter and as many receivers as necessary. Coded signals are set at the equipment by correct setting of two dials, which do not require skilled operators to use.

The receiver measures 2½ x 3 5-8 x 1 inch and weighs only seven ounces. It can be carried in the breast pocket of a man's suit with no difficulty.

It is planned to produce the system in two forms.

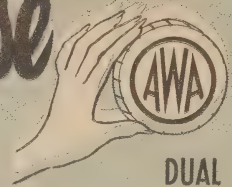
TWO MODELS

The first intended for general industrial use will have a capacity of 64 remote signal actuators. The "base" transmitter has a nominal output of 5 watts and an aerial power of 3 watts. This power it is claimed is sufficient for a distance of 2 miles.

The price of the transmitter and coder is expected to be about £500, and each receiver will cost about £60.

The second system is much larger, and will cater for 4600 receivers.

New Release



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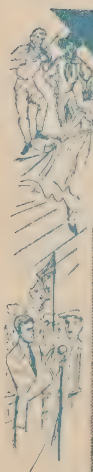
Type PA828 amplifiers may be operated from 240 volt or 6 volt battery supply, changeover being effected by alternate cables which are stowed in rear of housing. A standby switch is provided to conserve battery life.

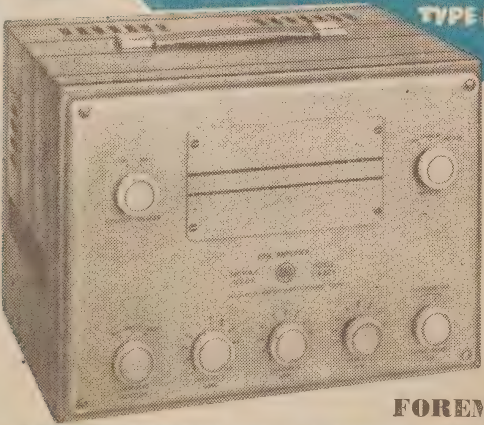
5 WATT AMPLIFIER

TYPE PA 828

20 WATT AMPLIFIER

TYPE PA 829





Type PA829 20 watt mains or 12 volt battery amplifier provides all facilities necessary for P.A Hiring

These include two microphone channels with third optional channel for microphone or pickup. Either high or low output pickups can be used. Features include a battery saving switch and a bass cut switch to control L.F. response when using horn speakers. A plug-in V.U. meter and monitor speaker with their associated switches are ancillary units.

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HIGH GAIN AERIAL SERVES ATN

The most familiar TV aerial to road travellers in Sydney is undoubtedly that belonging to the commercial station ATN which is located alongside the Pacific Highway at Gore Hill. This is one of the city's busiest roadways, and thousands have watched its progress as the lacework of girders climbed the sky.

THE mast itself was fabricated in Australia and is 427ft to the base of the aerial. The height of the aerial alone is 72ft, making a total of 500ft to the top of the entire structure.

Altitude of this kind is essential to TV stations because of the extremely high frequencies used, and the fact that, in general terms, radiation attentuates rapidly beyond the visual horizon. The higher the mast, the greater will be the station's primary coverage area.

This is one reason for selecting the site, which is on some of the highest ground around the city. Added to that of the mast, this gives the top of the aerial an effective elevation above sea level of 835 feet.

The main equipment of ATN is primarily Marconi designed, and was supplied through Amalgamated Wireless (Australasia) Ltd., its Australian representatives, and this includes the aerial array.

As can be clearly seen from the ground, the aerial is divided into approximately equal halves, each half being fed by a separate line with co-axial cable which runs up inside the mast from the transmitter.

This cable, which is of double section, uses two 3½-inch copper lines filled with air under a few pounds pressure to keep out moisture. The air is supplied by a pressure unit at the transmitter, and passes through a dehydrating process to control moisture content before being fed to the line.

The actual radiators are a series of dipole antennas arranged in sets of four, one for each of the rectangular faces of the mast itself which carries the feed sets, making 32 in all. There are thus 64 radiating elements.

Each face of the mast behind the dipoles is covered with a series of vertical rods to act as a reflector. This reflector not only adds to the gain of the aerial, but helps to control the radiated pattern from each of the four sides, so that the desired all-round-looking polar diagram will be obtained.

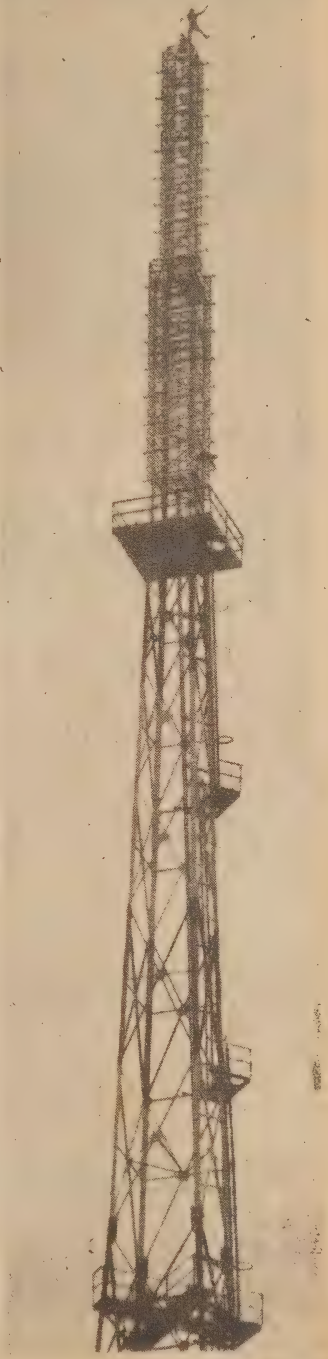
It also reduces the radiated field within the mast itself which carries the feed lines to each of the dipoles. Otherwise, these lines would pick up energy from the aerial, and this would create difficulties at the transmitting end.

The spacing between the dipoles and the reflectors is approximately one quarter wavelength.

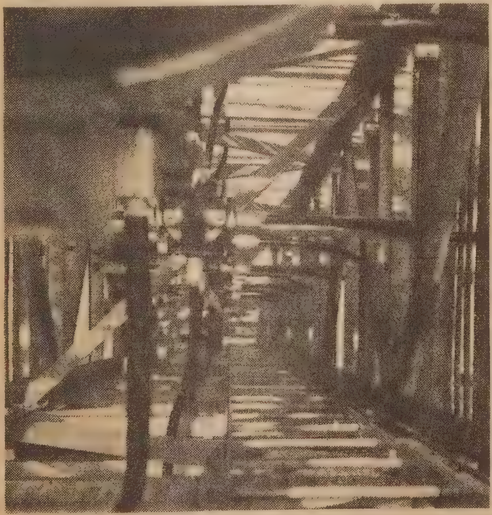
The purpose of dividing the aerial into two sections is to allow the radiated pattern to be controlled to give the most efficient coverage within the service area. Energy is fed to each half in unequal magnitudes, the top half receiving 70 per cent of the power from the transmitter, and the bottom half 30 per cent. The phase relationship between each half is also adjusted to depress the angle of radiation down toward the ground, so that the theoretical angle of the main lobe is one half degree below the horizon.

This ensures that there will be no null points in the pattern near the limit of range, due to the normal reflection from the ground, which would otherwise tend to tilt the radiated angle up-

(Continued on Page 123)



Right—The top of ATN's mast clearly shows the two sections of the aerial itself which commences just above the main platform. The dipoles mounted near their reflectors are clearly visible. The acrobat at the top illustrates by comparison the size of the structure.

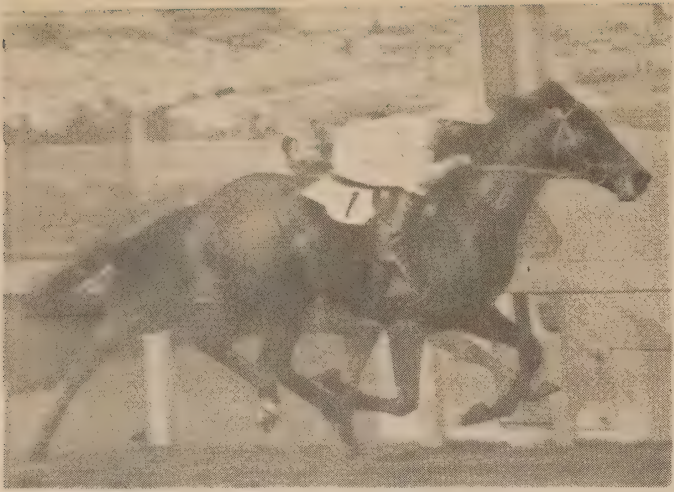


Left — This view taken looking up through the aerial section shows the co-axial feed lines which divide the power for transmission to the 64 dipoles.

THE MECHANISM OF MOVEMENT

The movement of all living things is based on definite laws which are unconsciously obeyed. When we observe an animal walking, running, jumping or flying, we rarely give a thought as to the whys and wherefores of the mechanism which enables the animal to perform these functions. Yet, behind it all lie natural laws applied unconsciously by the creature according to its size, shape and environment.

by Calvin Walters



In this unusual picture, the horses are at opposite ends of the gallop cycle. In the foreground the winner has all feet off the ground. The runner-up is fully stretched out, one hind leg is about to leave the ground and one foreleg about to take the horse's weight.

During the Christmas session at the Royal Institution, London, in 1951, a remarkable series of lectures was delivered by Professor James Gray, Professor of Zoology in the University of Cambridge.

The lectures were delivered to a juvenile audience which possessed no knowledge of biology, but so enthusiastically were they received by the adult component of the audience that Professor Gray decided to compile the lectures in a book.

The book, entitled, How Animals Move, deals with all phases of the movements of animals, fish, birds, reptiles, earthworms and so on. It is a remarkable work which I commend to all interested in such matters.

I am indebted to Professor Gray for much of the material for this article, but the subject is so exhaustive that I cannot hope to give more than a gleaning in the short space allowed me by the editor.

The author likens an animal somewhat to a car, in that, in order to move it must be provided with an engine, steering-gear and brakes.

If your car is stationary (and my old bomb is usually like that), it will not move off unless it gets a kick along in some way or other. You either have to push it, like mine, or use the engine.

The purpose of the engine or push, is to overcome the natural inertia of the car. Having been put in motion it will keep going until the force which set it in motion is withdrawn by another force acting in the opposite direction.

When we push with our hands we give an equal push in the opposite direction with our feet on the ground.

When the engine is used it delivers the same kind of force by means of the driving wheels.

A moving animal does the same thing when it gets under way. It must apply an equal and opposite force by means of its feet, tail, wings or any of the many methods Nature has provided.

To do this it must have a "propeller" just the same as a ship, car or aeroplane must have a propeller.

There is a marked difference between the propellers devised by man and those used by Nature.

With the exception of jet propulsion, all the propellers devised by man depend upon some sort of rotary action. In animals such rotary action is not possible, because every part of the living body is connected by nerves, sinews, muscles, blood vessels, and so forth. Continuous twisting of these would soon sever them.

Nature, therefore, makes use of rods and levers, such as legs, arms, fins, wings, etc.

NO DISADVANTAGE

The author points out that it is no disadvantage never to be able to use a wheel form of propulsion. It is as well, perhaps, for it would be a peculiar spectacle to see all sorts of animals, including man, getting about on self-contained scooters. It would certainly be a boon to the taxing authorities, for there would be a further excuse for us to need a licence for travel. This would be a further bother requiring, as it would, a number plate and tail light attached to the rear.

However, a wheel is really only a series of levers acting one after another.

Imagine a six spoked wheel. Attach a boot to each spoke remote from the hub, revolve the wheel in a clockwise direction and look at it side on.

It will appear for all the world just like a pair of legs walking along the ground, for the heel of each boot will touch the ground first, roll on to the toe, and when the toe lifts from the ground the heel of the next boot will contact the ground at the right moment.

WHEEL ANALOGY

This is exactly what a man or animal does with his feet. If you can imagine a man with six legs (personally I have never seen any, although I have seen plenty with two faces) with each leg revolving in a complete circle clockwise from the hip, you would get the same action as a wheel. If you imagine six on each side, with those on one side registering with the spaces between those on the other, the right and left feet will touch the ground in alternation and we would walk along.

This is, however, not necessary. All we need is one on each side swinging back and forth to get the same effect.

So long as one leg and foot leaves

the ground a moment before the other foot touches and so long as it is ready to do this at the right time it doesn't matter whether we have two legs like a man, six legs like an insect or a very large number like a centipede. They all act as propellers.

The engine which drives these propellers are the muscles and associated nerves and sinews. With these nature moves her levers up and down or from side to side. Thus a man propels himself with two spokes, a dog or horse, &c., by four and a centipede by many.

It is the muscles which are the driving force in all creatures.

In an earthworm the longitudinal muscles on each side of the body contract in a series of waves. When those on the front end contract (this end is hard to determine unless you are in the know) they pull the latter end along. The next row then contracts and pulls, and so on right along the worm.

A leech is provided with a sucker at either end. He is also provided with two sorts of muscles— longitudinal running along the body, and circular running around the body.

MOTIVE ACTION

When he attaches the front sucker, the rear one is free. The longitudinal muscles are stretched and the circular shortened.

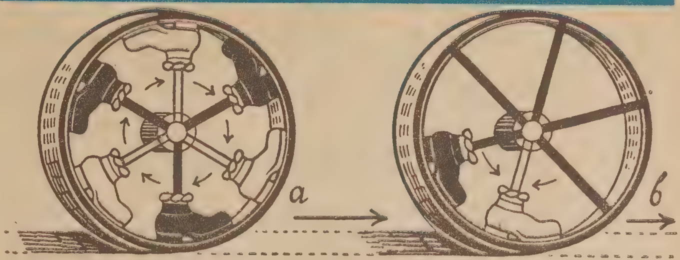
He thus pulls himself forward by shortening the longitudinal muscles and elongating the circular. When he reaches the extent of his pull he attaches the rear sucker and frees the front. The longitudinal muscles stretch again and the circular shorten and he is pushed along. Thus he alternately pulls and pushes.

In snakes and such wriggly things the action is somewhat different. Here the muscles on each side contract and relax alternately with the result that one side of the body is shortened and the other lengthened.

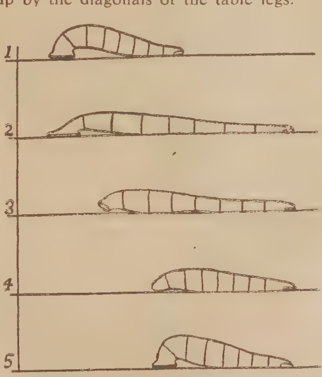
The reptile moves in a series of waves because the lengthening and shortening on each side is done in a definite order and not simultaneously. If such were not the case the reptile would stay in a straight line and not be able to move.

Now we will see what the author has to say about horses. He likens a horse to a table standing on four legs. Imagine such a table with a heavy weight standing bang in the middle. This represents the centre of gravity. If you now take away one of the legs the table will fall over because the centre of gravity is outside any of the four triangles made up by the diagonals of the table legs.

WHEEL ANALOGY OF FOOT MOTION



A six-spoke wheel rolling along on its rim can be regarded as six legs each ending in a foot. Only one 'foot' of the wheel is in use at a time, but as soon as the toe of one foot leaves the ground, the heel of the next foot comes into contact with the ground. We can replace the rolling wheel with its six spokes by two legs. If each swings forward when it has performed its task as a propeller, it comes into action again at the right moment.



How a leech moves. With the hind sucker fixed, the circular muscles contract and the body moves forward. (1,2). The front sucker fixed (3) the hind sucker is released and the body drawn forward (4). The hind sucker is now fixed(5).

If the weight, or centre of gravity, is moved to one end of the table any one of the legs at the other end can be removed without the table falling over, because the centre of gravity lies within one of the triangles aforementioned.

Thus if the centre of gravity of a four-legged animal does not lie midway between the front and hind legs the animal can always support itself on three legs or on the triangles made by the two feet nearest the centre of gravity and one or other of the two legs that are furthest from it.

If this were not so the animal would fall over immediately he lifted one foot from the ground. He would have to remain where he was because he wouldn't be game to move.

There are two main classes of animals in the great group of mammals. Those where the centre of gravity lies near the fore feet and those where it lies near the hind feet.

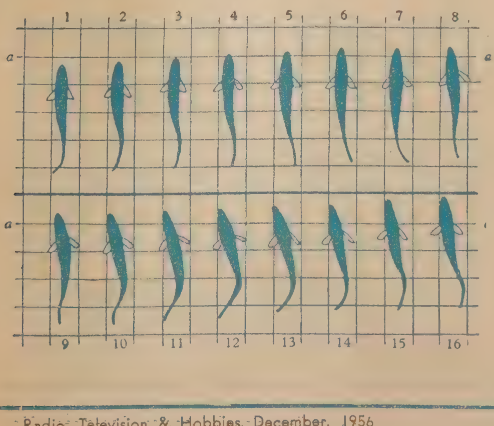
CENTRE FORWARD

The horse has his centre of gravity near his forefeet. That is why a horse will rest with one of his hind feet resting lightly on the ground. He can't lift his forefeet off the ground in this way because this would be like taking a leg off the table which is nearest the aforementioned weight. He would fall over.

That is why a horse will willingly lift his hind foot to kick out or have it shod by a blacksmith but the fore foot cannot be lifted without some force and the blacksmith has to support the animal with his own body. The only way you can lift a horse's forefoot off the ground is to rock him backward until he almost sits down. In this way he shifts the centre of gravity to the rear.

When the horse starts to move off he moves his forefoot forward. This has the effect somewhat of shifting the centre of gravity to the rear and he satisfies the condition whereby he can now lift the diagonally opposite hind foot without falling over. At the same time his muscles propel him forward, he lifts the other forefoot and then its diagonally opposite hind foot.

If the geometry is worked out it will be found that it satisfies the conditions that no foot is lifted unless the centre of gravity lies over the triangle marked



When a fish moves its tail from side to side, its body bends under the pressure of the water so that the leading surface of the tail fin is nearly always held at an angle to the axis of its body In 1-4 the tail fin is moving from left to right. In 5-7 the fin slope is changing. In 7-10 the fin is moving from right to left. In 10-12 it feathers again. In 12-16 it moves from left to right.

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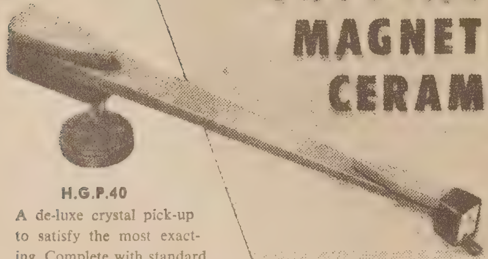

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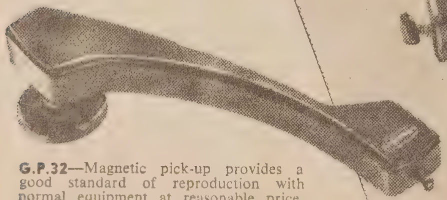

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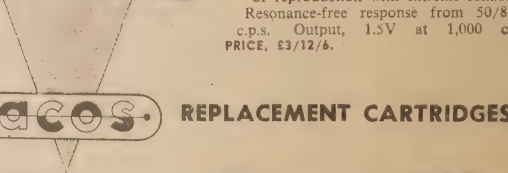

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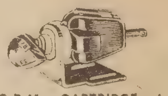

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out by the other three. "As each foot comes down it forms the corner of a new triangle of support and as soon as the centre of gravity comes to lie within this triangle the fourth foot, the one not involved in this triangle, can move."

As the animal moves faster he alters his gait somewhat and at times two feet may be off the ground at the same time. In this case, however, he moves his feet irrespective of where the centre of gravity lies, but is moving fast enough to put his foot on the ground again at the right moment and corrects the position. He sort of forces himself forward against his will and has to keep moving feet in order not to fall over. Some horses I have backed at the races never seem to learn this trick.

Such animals as rabbits, bears and squirrels have their centre of gravity placed well back toward the hind feet. These animals can therefore lift their fore feet, but find difficulty in lifting hind feet two at a time unless they stand on their heads.

Others have the centre of gravity above the hind feet. No weight is then on the forefeet and the animal is two-footed like a man.

CENTRE BACK

The kangaroo has its centre of gravity well behind the hind feet and his triangle of support is provided by the two hind feet and the tail.

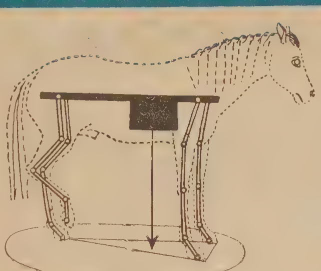
The author goes into some interesting mathematics regarding the speed of animals and why. There is no room here for such discussion.

It is interesting to know that a galloping horse has all his feet off the ground at one period of the cycle, contrary to general opinion. Sometimes, a horse in sudden fright lifts both his forefeet from the ground. This is because he exerts a strong backward thrust with the hind feet, which acts at the level of the shoulders. This acts as a "turning couple", reduces the weight on the front feet and lifts them from the ground. They cannot stay there for long, however, and the horse immediately drops again, but the strong backward thrust bounds him forward.

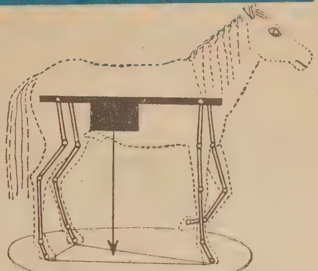
Now we come to fish. How does a fish swim? With his tail, or does he use his fins as paddles?

All fast-swimming fish are thick at the front and taper off toward the end. At this end is the tail or "caudal fin".

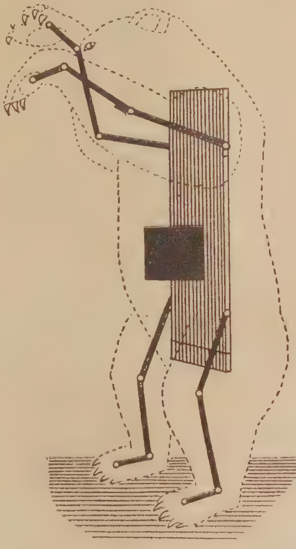
CENTRE OF GRAVITY IS FORWARD



The centre of gravity of a horse's body normally lies nearer to the forefeet than to the hind feet — thus it can stand with one hind foot off the ground.



If a horse is to lift a forefoot, its body must be moved backwards until the centre of gravity lies within the triangle marked out by those feet on the ground.



A bear can bring the centre of gravity of its body to a point vertically over the area marked out by the soles of its hind feet, thus becoming a biped.

This fin is held vertically until the fish starts to swim. Then it sweeps from side to side.

To find this out the author arranged a tank with the bottom ruled off in squares, against which photographs were taken of a fish swimming.

It was found that when the tail moves from one side to another the fish's body bends under the pressure of the water so that the leading surface of the tail fin is always held at a slant to the axis of the fish's body, except at the end of every stroke.

Then it reverses and moves toward the other side of the body's axis.

"As the inclined tail fin moves from side to side it pushes the water away from its surface in a backward and sideways direction relative to the axis of the fish's body. The inertia of the water resists this movement, and, consequently, the body of the fish is acted upon by a force equal and opposite to the force that the tail applies to the water." Thus, the tail fin can be regarded as the blade of a propeller, except that it is travelling from side to side instead of rotating, says the author.

SIDE MOVEMENTS

These side to side movements are due to the alternate stretching and shortening of the side muscles of the fish similar to that of a snake.

The fins of a fish act merely as stabilisers to keep him on an even keel.

Here is an interesting thing which the Professor has worked out, but you can't use it very well if you are a fisherman because it will take all the glamor out of the story about the big one that got away.

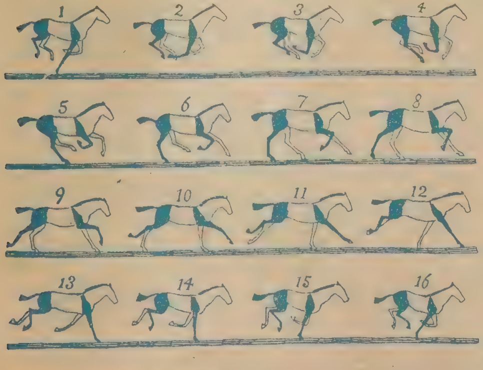
We have all experienced the "mighty" tug of a fish we didn't land and estimated him to be at least five or six pounds.

Here is the story in the Professor's own words.

"When a fish takes the fly and begins to run out the line from the reel we have the impression of high speed and great strength; but we must bear in mind two things.

First, each revolution of a trout reel seldom pays out more than one foot of line, so that if a reel is revolving four times a second (thus causing a good deal

(Continued on Page 123)



A galloping horse never has more than two feet simultaneously on the ground and during part of the time it is in the air. Note how the limbs are flexed when swinging forward. The feet are moving backwards rapidly before they strike the ground.

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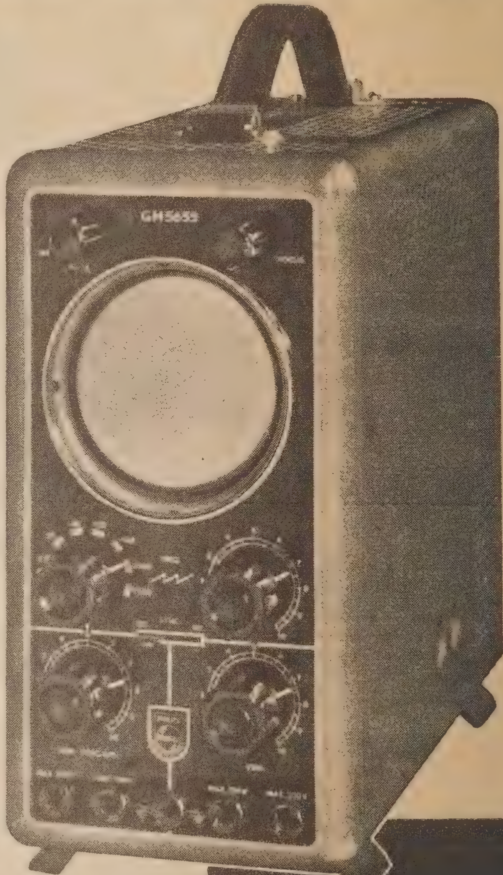

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Technical Review

GRAMO-PREAMP WITH TRANSISTORS

One of the important links in the chain of hi-fi components is the preamp, a link which often becomes the limiting factor in the quest for low distortion, low hum and freedom from microphonics. Insofar as balance is concerned, the preamp — equaliser is almost always the sole controlling element.

OVERSEAS, transistors are rapidly coming into favor for preamps as this extract from Radio-Electronics indicates. Unfortunately the range of transistors available here at present is not large.

Transistors alone offer freedom from certain hum sources and microphonics common to tubes. Generally speaking, transistors are more linear than tubes.

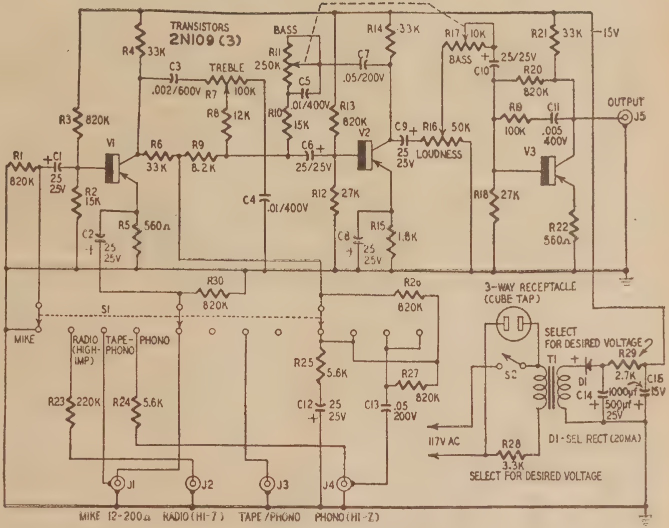
This preamp features low distortion, low hum and low noise, plus the advantages of continuously variable tone controls. With a bass boost ranging from flat to 20 db up and a treble-control range of 10 db up to 10 down, more or less, lows and highs can be balanced as well for low-level relaxation music as they can for high-level exhilaration sound.

In the output stage a 2N109 is used in a common-emitter circuit which is analogous to a grounded-cathode tube hook-up. The signal from the preceding stage is fed to the base; there is collector load resistor R21; an emitter resistor R22 and a base-bias network R18 and R20.

The emitter resistor provides a degree of degeneration which reduces distortion and—of equal importance—stabilises against the effects of temperature changes. It also helps the circuit accept a range of transistors with considerably different characteristics.

However, at this stage of the art (or science) some transistors may still require individual circuit adjustments—and this can be done by increasing or decreasing the value of either or both of the resistors in the bias network.

The bias adjustment is for obtaining a voltage at the collector which is about 40 to 50 pc of the collector supply voltage. Thus the collector voltage should be about 6 to 7 for a 15-volt collector supply.


TRANSISTORS 2N109 (3)
R1 820K
C1 25 25V
R2 15K
R3 820K
R4 33K
R5 560Ω
C2 25 25V
V1
C3 .002/600V
TREBLE
R7 100K
R8 12K
R6 33K
R9 8.2K
C4 .01/400V
BASS
R11 250K
C5 .01/400V
R10 15K
C6 25/25V
C7 .05/200V
R13 820K
R12 27K
V2
R14 33K
R15 1.8K
C8 25 25V
C9 25 25V
R16 50K
LOUDNESS
R17 10K
BASS
C10 25/25V
R20 820K
R21 33K
-15V
R19 100K
C11 .005 400V
V3
R18 27K
R22 560Ω
OUTPUT
J5
R30 820K
S1
MIKE
RADIO (HIGH-IMP)
TAPE-PHONO
PHONO
R2o 820K
R25 5.6K
C12 25 25V
R27 820K
C13 .05 200V
R23 220K
R24 5.6K
3-WAY RECEPTACLE (CUBE TAP)
SELECT FOR DESIRED VOLTAGE
R29 2.7K
T1
S2
D1
C14 1000µf
500µf 25V
C15 15V
117V AC
R28 3.3K
SELECT FOR DESIRED VOLTAGE
D1 - SEL RECT (20MA)
J1
J2
J3
J4
MIKE 12-200Ω
RADIO (HI-Z)
TAPE/PHONO
PHONO (HI-Z)

Schematic diagram of hi-fi preamp using three transistors.

This principle applies to the first and second stages (both of which use 2N109's) although only one 2N109 out of a dozen tested required a change in the bias network.

The first stage will be recognised as either a common-emitter or common-base circuit. Actually, it is either, as desired—the switch not only selects the input but applies it to either the base or the emitter. The selector switch has two other functions: it connects or disconnects the components which convert a constant-velocity to a constant-amplitude characteristic (R6 and C13); it inserts series load resistors (R23 and R24) where needed to match the input impedance to a particular source.

MIKE POSITION

The MIKE position connects a low-impedance microphone to the emitter of the transistor in a common-base circuit. The output of the transistor is attenuated by R6, R25 and C12, but in a non-frequency-selective manner. This input circuit is for sources with output impedances of approximately 12-200 ohms and may be used with low-level lines as well as mikes.

The RADIO position connects the output of an AM-FM tuner to the base of the transistor in a common-emitter circuit. The input signal goes through R23 which attenuates it to the level of a phono pickup and at the same time increases the input impedance of the preamp as "seen" by the tuner. The output of the transistor is attenuated the same as for mike input.

The TAPE-PHONO position connects the output of a tape reproducer head or a low-impedance phono pickup to the emitter of the transistor in a common-base circuit. The output circuit of the transistor (R6 and C3) converts the velocity curve to an amplitude curve.

The PHONO (Hi-Z) position connects the output of a high-impedance magnetic pickup to the base of the transistor in a common-emitter circuit. R24 is a series load resistor—a higher value will accentuate highs, a lower value lows. The transistor output is converted from a velocity to an amplitude characteristic as in the tape-phono position.

Looking at the output circuit of the first stage, the treble control stands out as a very simple but effective circuit. Highs are picked off the collector by C3 and adjusted in level by R7. At the other end of R7, highs are bypassed to ground by C4. R8 and R9 are simply isolating resistors which prevent objectionable circuit interaction.

The second stage is the bass booster.

(Continued on page 127)

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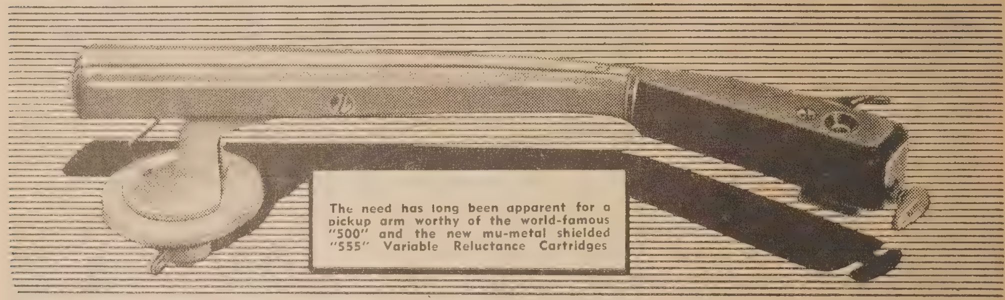

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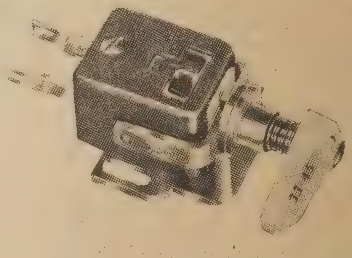

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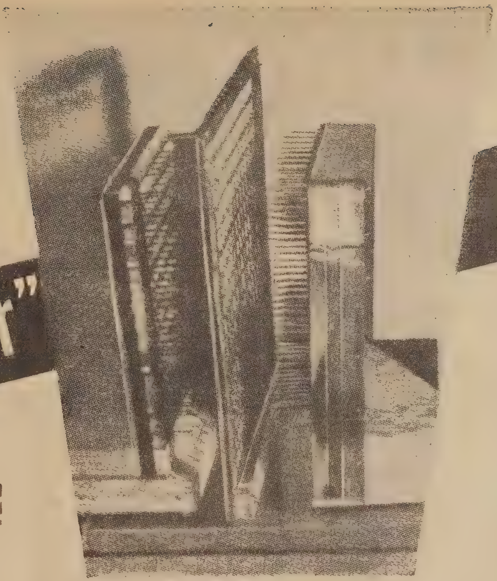

Fig. 1. Needle matrices and grid structure were used in original model of Tombs' "Corona Loudspeaker." Surface area is ¼ sq. ft

New methods of reproducing sound are under world review at the moment—one direct result of the great interest in hi-fi. Although electrostatic speaker appears the most promising present competitor to the standard dynamic, much developmental work is being done in other fields.

A LOUDSPEAKER which converts electrical energy directly into sound without any moving parts, and which reproduces the entire audio spectrum, has long been a dream of audio engineers and loudspeaker designers. The demonstration of a prototype of such a speaker in England (where it was invented) and recently before the New York Section of the Audio Engineering Society indicates that the dream may finally become a reality

The inventor of the "Corona Loudspeaker", so named because it is based on the corona-wind phenomenon, is Dr. David M. Tombs, a New Zealand born engineer who was formerly Senior Lecturer in Telecommunications at the Imperial College of Science and Technology of London University, and now director of the research department of Hoover Ltd.

Patent applications have been filed on the "Corona Loudspeaker", and exclusive rights for North America have been assigned to the Televex Co.

It has been known for many years that corona, a byproduct of high voltage, is accompanied by a movement of air away from the discharge point. TV service technicians and experimenters have, on occasion, been made aware of this effect when working in or near the high voltage sections of TV receivers.

Reasoning that any source of wind might also be a potential source of sound, since sound is, after all, a sort of AC wind, Dr. Tombs constructed special apparatus in order to study the phenomenon more closely and to find a method of modulating the corona winds.

A convenient method of observing the direction, strength, and pattern of the winds was found by injecting smoke into the corona field

Starting with a pair of electrodes, one of which was sharply pointed and the other blunt, it was found that a corona wind moves away from the sharp point only. The next step was to mount a smooth ring coaxially around the sharp electrode, in the expectation that it might be made to act as a grid to control the corona current, and hence the corona wind.

The inventor found that with a grid potential of "the same order of voltage as the sharp electrode" there is a position of the grid with respect to the tip of the sharp electrode "at which comparatively small changes of the grid potential produce a maximum effect on the intensity of the corona wind . . ." This is shown diagrammatically in Fig. 2A.

The "plate characteristics" of this corona triode were plotted for various geometries and voltages. (By various geometries is meant that the relative distances between electrodes and grid were varied, as well as the diameter of the grid itself.) The resulting family of curves bears a striking resemblance to those of certain vacuum-tube triodes.

In this application the electronic amplification (a voltage gain of about three) is "thrown away" since we are interested only in the byproduct, namely, the acoustic output. This output can be described as modulated DC. That is, there is both sound and a steady, background, uni-directional wind.

Dr. Tombs next experimented with two sharply pointed opposed electrodes and found that each produces a wind, the "positive" wind being stronger than the "negative" one. Placing the ring or grid nearer the positive electrode, he found that by suitable combinations of voltage and position he could adjust the positive wind to equality with the negative, so that with no signal input there is no "net" wind

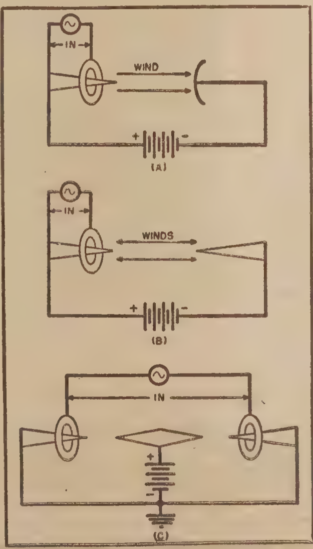

Fig. 2. (A) Simplest form of "Corona" triode speaker which produces steady "background" wind. (B) advanced form in which winds are balanced on no signal. (C) A push-pull version of the original "Corona Loudspeaker."

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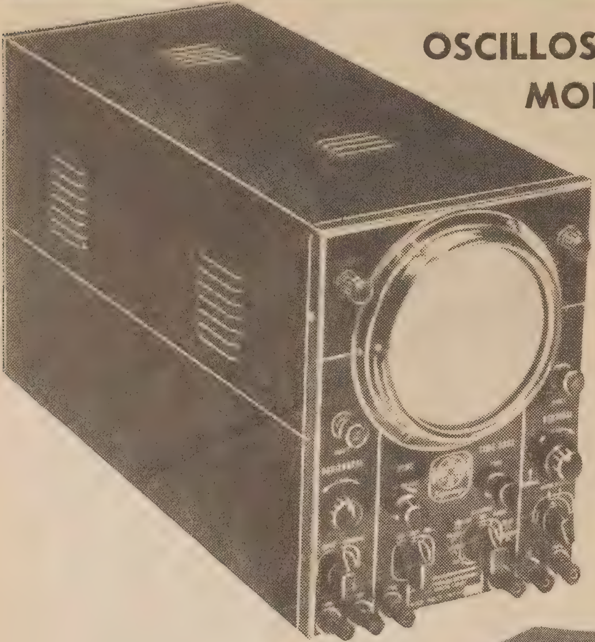
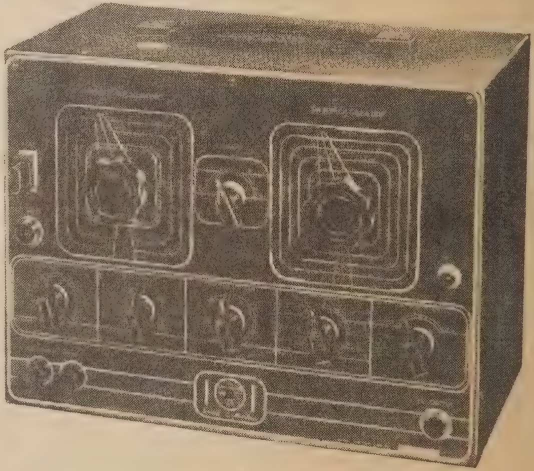


OSCILLOSCOPE 5in. MODEL TVR/C5

This 5in Oscilloscope has been developed for TV and radio-servicing and for general purpose use at frequencies from 10 cycles per second to 5 megacycles per second. The frequency response of the vertical amplifiers in the normal position is 10 cycles to 1 megacycle, plus or minus 1db. In the wide band position the frequency response is from 5 cycles per second to 3 megacycles per second, plus or minus 1 db. The sensitivity in this position at 6 megacycles is minus 3 db. Horizontal amplifiers have a frequency response at full gain from 20 cycles to 1 megacycle, plus or minus 2½ db. The time base generator has a frequency range from 15 cycles per second to 250 kilocycles in seven coarse steps with a fine control.

MODEL TVR/SM

The Model SM, combined sweep and marker generator, has been especially developed to simplify the exacting task of aligning the tuned circuits of TV receivers.
Used in conjunction with the University C3 or C5 or similar oscilloscope the actual shape of intermediate frequency and overall selectivity curves is made clearly visible.
The Model SM provides an RF signal which is made to sweep several megacycles either side of the centre frequency selected by the tuning dial and range switch.
Tuning range (1) covers sound IF bands including 5.5 and 10.7 mc/sec.
Range (2) covers all TV intermediate frequencies including Australian standard and non standard IF's.
Range (3) covers low band channels 1 to 3.
Range (4) covers high band channels 4 to 10.
All tuning ranges are on fundamentals to avoid spurious signals or beats.
A crystal controlled 5.5 mc/sec oscillator is also included to provide two simultaneous marker indications and to provide a means for accurately checking the tunable marker.



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and that "an alternating potential applied to the grid causes the air to pulsate and hence to become a source of sound". This, then, is an embryonic loudspeaker capable of producing a pure AC output. See Fig. 2B.

The amount of sound produced by a single corona triode is very faint, so that it becomes necessary to parallel or stack a number of them.

FIRST MODEL

The first small model was constructed with a needle spacing of one-half inch, and with an area of a quarter of a square foot, as shown in the photograph. (Fig. 1) Even this is still too small to produce any real volume, although it could be heard in the back row at the demonstration given before the AES, which was in a fair-sized recording studio.

It is likely that at least four square feet of area will be required to produce adequate volume for home hi-fi systems, and this is still fairly small when compared with some of the better wide-range conventional speaker systems. Also it is possible that further research will improve the efficiency factor and thus reduce the size requirements.

THEATRE USE

For theatre and auditorium use the area would have to be increased proportionately to the power outputs required, or a number of "standard-sized" units could be driven in parallel. The cubic area requirements are likely to be non-critical, since the device itself can be made very thin, and it is only necessary to provide suitable baffling to preserve the low-frequency response.

This will probably be of the infinite baffle type and consist of a fairly shallow enclosure filled with suitable material to absorb the backwave.

Thus far the efficiency of the "Corona Loudspeaker" is roughly comparable to that of electrostatic speakers, if one takes as a measure of efficiency the available sound output per unit of area.

If we attempt to measure efficiency, however, on a "watts in" versus "watts out" basis, we run into difficulty because conventional speakers require watts of audio power, whereas the "Corona Loudspeaker" requires only an audio voltage to drive it, irrespective of its size, and the power comes from a DC source across the needles.

PUSH-BUTTON VERSION

The frequency response of the "Corona Loudspeaker" is much smoother than that obtained with cone type speakers, and it is expected that in its perfected form it will be essentially flat from zero to or beyond the upper limit of audibility. Even in its present form there is no audible resonant frequency at the low end.

In the single-ended form, as shown in Figs. 1, 2A and 2B there is certain amount of distortion in the output. Fortunately, however, the device lends itself with equal facility to a push-pull configuration, as shown in Fig. 2C, and it is expected that in this version, together with further refinement and the possible addition of over-all negative feedback, the output should be characterised by a vanishingly low distortion content.

In the push-pull form there will be the additional advantage of having the outer electrodes at ground potential, which should eliminate any possible shock hazard.

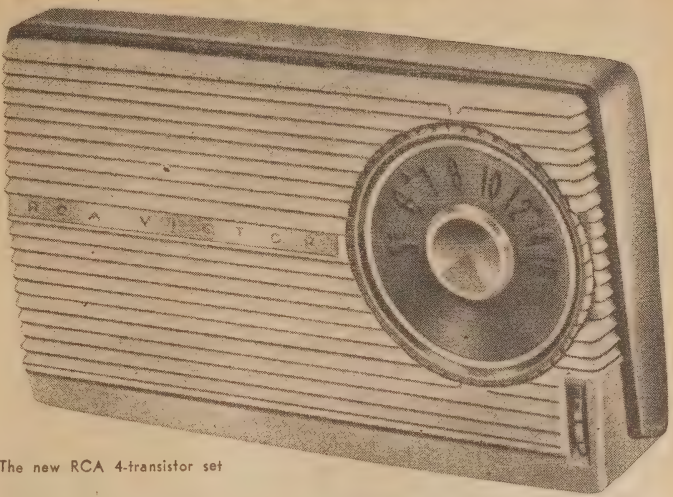
Audio engineers who have seen and heard the "Corona Loudspeaker" even in its present elementary form are considerably impressed with its possibilities, and some have expressed the opinion that it may well be the "loudspeaker of the future."

PUSH-PULL VERSION

However, you will not be able to buy one next week, and possibly not for another year or so, since further research and development are required to determine all the optimum parameters, both mechanical and electronic, before it can be produced commercially. But when it does reach the market, the "Corona Loudspeaker" should prove to be a contender in the hi-fi sweepstakes.

Radio and TV News.

NEW TRANSISTOR POCKET RADIO



The new RCA 4-transistor set

Two new all-transistor pocket-sized radios, featuring recently developed improvements in circuitry and loudspeakers have been announced by RCA Victor.

Both models used four transistors, and weigh approximately 1lb each. They have two-tone cases of non-breakable plastic.

The Winsome, advertised at about £18, will be available in either two-tone grey, or turquoise and antique white. The Stetson, advertised at about £21, will include a plug-in for an earphone, and will be available in a choice of charcoal and antique white, or pink and white.

The development of one of the smallest loudspeakers ever built for commercial radio receivers, plus new advances in all-transistor circuitry, provide these tiny sets with a tone quality and performance comparable with many larger radios.

The loudspeaker is only 2⅛in in diameter, and little over ½in thick—about half as deep and much lighter in weight than those previously used.

Other advances include improved iron-cored sub-miniature transformers to provide greater sensitivity and selectivity, a four transsistor plus diode detector circuit, and AVC.

Both sets are powered by a 9-volt mercury-type battery. The cases measure 3 5/16in high, 5½in wide, and 1½in deep.

Each is tuned by a large, circular dial set flush with the front surfaces of the grills.

RCA also make larger 6 and 7 transistor radio sets.

GRAINLESS COATING FOR CRT

CONVENTIONAL cathode-ray tube screens consist of powder phosphor settled on a surface of glass or other material. Incident light will be scattered from particle to particle, giving diffuse background illumination. If the phosphor is deposited as a uniform, grainless, layer instead of powder, the diffuse scattering is absent and higher contrast and resolution are possible.

For a zinc sulphide screen, the basic process is to bring together, at the surface to be coated, an atmosphere of hydrogen sulphide and the vapors of zinc or zinc salts, along with an activator.

The glass plate to be coated is supported in a quartz container at a temperature of 400 C to 700 C as shown in the diagram.

The layer of zinc sulphide produced in this way is durable and so firmly bonded to the glass that it can be put through the same polishing operations as the glass itself. The screens will stand temperatures as high as 600 C in a dry atmosphere with essentially no damage.

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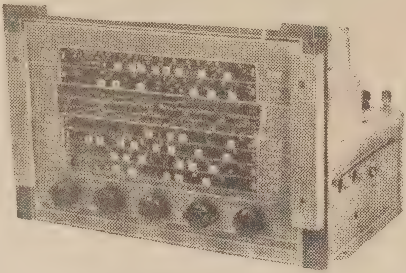

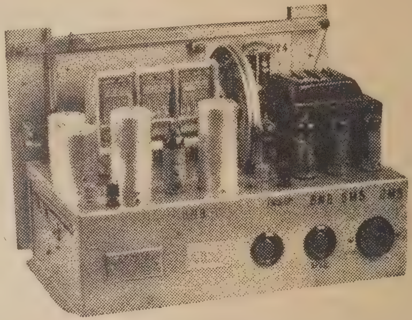

NEW ● Ultra modern circuit using nine high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent interstate reception and a short wave range of 12,000 miles. All valves used are the new Philips nine pin innoval series.

NEW ● Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving + or — 15db. boost or cut at 50 cycles L.F. and 10,000 cycles H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favorite recordings.

NEW ● Dual speaker combination using a heavy duty woofer (12in M.S.P. Jensen AU54 special) with matching 6in tweeter and cross-over network giving a frequency response of 46 to 13,000 cycles. Speakers are mounted coaxially making only one 11in mounting hole necessary.
If required the new Magnavox high fidelity twin coned speaker can be supplied.

NEW ● Large calibrated edge-lit dial in plate glass (11in x 7in) with main stations of each State in prominent type Dial fitted with counterweight drive giving smooth tuning Indicator lights are fitted showing which band is in operation. Dial can be supplied in cream, black or brown with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW ● Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.

All chassis are wired for the fitting of an F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for grammo motor.
Power switch is fitted to volume control, radiogram switch combining with wave change switch Audio end of set can be used with T.V receiver if required.

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A New 10-Valve Dual-Wave Radiogram Chassis

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The ideal chassis for those difficult locations where reception is doubtful. Specifications as nine valve unit but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands.

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livers over 10-million watts—enough power, if generated continuously, to provide the electric power needs of a city of 25,000 people.

A major technical problem was the development of a cathode that could supply the enormous electric current required by such a tube. The cathode had to operate at temperatures up to 3100 deg F—greater than the temperature of molten iron from a blast furnace.

Investigation proved that no existent cathode material would stand up to the power generated by "Big Maggie", and new alloys and fabrication methods were therefore pioneered. New design approaches, such as "transparent vacuum tight portholes" to allow the release of the radar waves, were required. In this instance a special glass window, dinnerplate in size but quite thin, had to be developed to withstand the intense cathode heat, and a total atmospheric pressure as great as 400lb.

SPARKING BARRIER

Two years of research and development work were also required to break the initial "Sparking Barrier", a power limitation occurring in the magnetron and resulting in a breakdown of vacuum insulation between the high potential elements within the tube. With the "Sparking Barrier" now pushed to 10 times higher levels than ever before realised in magnetrons, they can develop more than 10-million watts for much longer periods of continuous operation than was heretofore possible.

X-rays by phone

THE Albert Einstein medical centre has received x-ray films over telephone wires from New York 100 miles away.

Dr. J. Gershon-Cohen, radiologist, has been carrying out the tests over the telephone circuit in co-operation with Dr. Bernard Wolf.

They reported "excellent results".

Dr. Gershon-Cohen predicted that facsimile transmissions of x-ray films at small hospitals in outlying areas might enable expert radiology service from large medical centres in a matter of minutes.

Film was fed into a transmitter, where it was "scanned", line by line, by a light beam.

A photocell picked up the light signals and developed a current proportionate to the amount of light.

Installation cost would be about £1750.

Sound radar

A NEW lightweight radar set which can detect a single soldier half a mile away is announced by the US Army.

The portable device, designed in the laboratories of the Sperry Gyroscope Company, permits front line soldiers to "see with their ears".

Extreme lightness and ruggedness was attained, the army said, by eliminating the usual radarscope which produces visual signals on a luminous screen.

Instead, a moving object produced sounds of a distinctive character in the headphones of the set.

The Sperry set reveals the difference between fixed and moving targets at ranges up to three miles.

In the hands of trained ground operators, it distinguishes a vehicle from moving personnel, and indicates whether a vehicle moves on track-type treads or wheels.

Cold atomic energy

A US Navy scientist believes atomic energy can be generated through extreme cold instead of heat.

The scientist, 40-year-old Robert Carroll, claims that if the type of super energy he envisions can be made available, space travel at a speed faster than that of light could be possible.

His theory challenges two long-accepted scientific concepts — that 459.6 degrees below zero Fahrenheit is "absolute" zero; and that the velocity of light, 186,300 miles a second, is the fastest speed theoretically attainable.

BBC'S NEW MOBILE STUDIO

An engineer at the controls of the new mobile studio. Through the observation window, an interviewer can be seen.

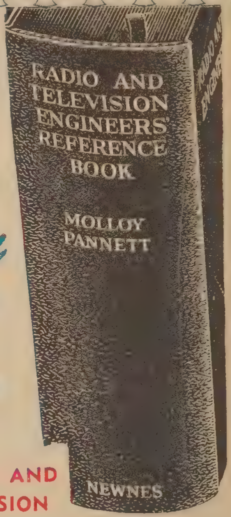
A NEW mobile studio and control-room designed by the BBC's engineering division is now on the British roads and proving of considerable value in handling outside broadcasts of the more complicated type, and at the same time providing studio facilities for interviews.

The new vehicle weighs nearly 4½ tons and is 22ft long, 7ft 6in wide and 9ft high from road level. It contains an accoustically-treated studio, some 10ft long by 7ft wide, together with a control-room which provides facilities for controlling the output of the studio and a number of external sources, such as commentators' microphones which may be located at scattered points over the site of a large outside broadcast. Provision is also made for recording and reproducing programs, for the introduction of effects from phonograph discs and for the reception of speech from commentators using a radio microphone.

Telephones are provided for communication with permanent BBC centres and other points, while the control engineer's and producer's positions are equipped with talk-back facilities enabling them to speak to the studio, or to the commentators for briefing.

The whole equipment can be operated from the public electricity supply or from built-in batteries which can be recharged whenever a mains supply is available.

Give yourself a Christmas present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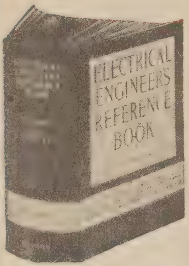
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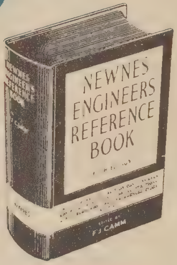
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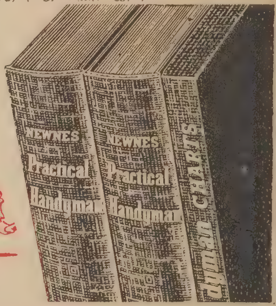
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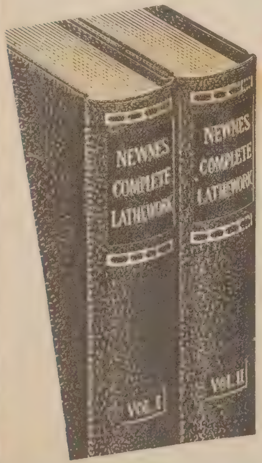
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TV balance sheet

PEOPLE paid almost £9½-million for advertisements on Britain's commercial television in its first year.

Programme contractors received a total of £9,487,133 for 33,436 advertisements — an average of £284 an advertisement.

In London, where Independent Television operated the full 12 months period —September to September — 15,836 advertisements yielded £5,686,515.

In Birmingham, where ITV has been operating only since February, 11,652 advertisements brought in £1,728,383.

In Manchester, where ITV, has operated since May, 5948 advertisements cost £2,072,235.

Releasing the figures, ITV did not announce its profit for the year.

Last week for B.B.C., in opposition to ITV, said the competition had forced the operating costs of its television service to more than £7 million — an increase of about £2 million on the previous year.

The BBC, also admitted recently that viewers spent twice as much time watching ITV as they did watching the BBC programmes.

TV in Ark Royal

ARK ROYAL, Britain's biggest aircraft carrier, has its own TV station.

The Ark Royal, which is now re-commissioned, has 50 17in table model receivers.

The TV studio aboard the ship has a camera, control unit, amplifying equipment, monitor sets and a cine projector.

Whenever the ship is at sea and far from home waters, sailors off watch will be able to sit in their mess decks and recreation rooms watching telefilms or "live shows" put on by the ship's company.

When the Ark Royal is within reception distance of British TV transmitting stations, or "swinging around the buoy" in harbor, the crews will see both the ITA and BBC programs.

The ship has a normal complement now of 2300 officers and men.

Cinerama at sea

CONVERSION of an obsolete aircraft - carrier into a floating movie theatre is contemplated by the US Information Service. Its purpose would be to visit ports all around the world, where Russian propaganda is busy.

Columnist Roscoe Drummond says, "Criticism may be expected from some of the sophisticated experts on US propaganda, jeering at anyone thinking he could sell America with cinerama.

"Nobody is proposing any such thing.

"Those who are drawn to cinerama will see much else—an atoms-for-peace exhibit, displays of how the American economy works for its people and enables US to help others."

Flight deck of the carrier will provide space for a cinerama theatre seating 2000 persons and leave room for other exhibits.

The cinerama suggestion, says the columnist, "springs from the notable success which US had in using widescreen films in exhibits at Damascus and Bangkok."

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That's why S.T.C. Brimar valves are fitted to radio communication equipment and navigational and air navigational devices throughout the world. In your own radio work too, S.T.C. Brimar valves will give you top-line performance and the highest degree of reliability. Specify S.T.C. Brimar valves for all your valve needs.

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F133

NEW PORTABLE SET FOR 1957

Right now, with holidays coming up, there are doubltess plenty of readers looking for a circuit to which they can build—or rebuild—a portable receiver. Well, here it is—a simple, straightforward design, capable of working either from batteries or power mains.

by

Wes Yashin

A picture of the finished portable. Ours was in fawn leatherette, with a red speaker grille cloth and cream knobs. Although we used a fairly conventional type of cabinet, more elaborate designs will suggest themselves to readers who are handy at woodworking.

THE set has its own built-in aerial, has high sensitivity and more power output as a mains receiver than any portable you've heard to date.

A good portable should be compact, efficient and useful not only for the holiday season but at all times. Our latest set is designed to meet these requirements.

It is designed for a dual purpose, as a straight-out portable for the beach, picnics, etc., and as a mantel set for the weekender or a second set around the home. You simply open the back lid and push in an AC power supply or batteries, according to your requirements.

NOVEL CIRCUIT

In the design of our new portable we deliberately aimed at simplicity of construction, both in respect to the chassis and the cabinet. There is nothing complex about either, though the chassis does contain a rather novel circuit trick.

When connection is made for AC operation an AC power valve is brought automatically into circuit, more than doubling the maximum power output.

The size and shape of the cabinet is governed largely by the nature of the batteries. In this case we settled for the larger types, which cost a little more to buy but give much better economy in terms of battery life versus cost.

The A battery will need more frequent replacement than the B batteries and, while this is something of a disadvantage, it is largely unavoidable.

One important point about using a large battery compartment is that it also allows a larger-than-normal speaker to be used, ensuring good reproduction and adequate sound volume.

TWO LINES OF APPROACH

Much has been said in past issues on operating portables from the AC mains and, from the design point of view, it resolves into two distinct lines of approach.

In the first case the filaments may be wired conventionally in parallel, necessitating a special metal rectifier and filter system for the required 1.5 volt DC supply. Our Power Supply for Personal Portables, recently described, is an illustration of this approach.

An alternative approach is to wire the filaments in series, typical requirements for a five-valve portable being nine volts at 50 mA. This amount of current can be easily handled by an ordinary rectifier and filter system, and there is no need for the use of a battery to stabilise and filter this supply.

The series filament connection is harder to wire but has the added advantage of offering "free" grid bias, by reason of the different filament potentials.

Looking at the circuit, the sequence of stages is quite conventional. Grid, plate and screen connections are likewise and call for little comment. Some explanation, however, is warranted for the filament and AVC network, as already mentioned.

FILAMENT NETWORK

Referring to the circuit, it will be seen that the filament network is shown separately, with the pin numbers marked. The 3V4 is counted as a 3-volt tube, so that the filament string requires 9 volts at 50 mA.

Under actual operating conditions the high tension return current of valves at the positive end of the filament string must flow to the earthed end through the filaments of the remaining valves.

If allowance was not made, the 1S5, for example, being at the earthy end of the string, would carry the initial 50 mA plus some 13 mA of HT return current.

Whilst full correction would necessitate a resistor across each separate filament, we have found that it is sufficient to add three resistors, namely, one across the negative half of the 3V4 filament, one from the negative side of the 3V4 filament to earth, and one further down the string, from the positive side of the IF amplifier to earth.

Suitable bypass capacitors are also shown, their purpose being to minimise interstage coupling at both RF and audio frequencies.

The sequence of filaments in the network has to be worked out so that each valve can operate with its correct bias.

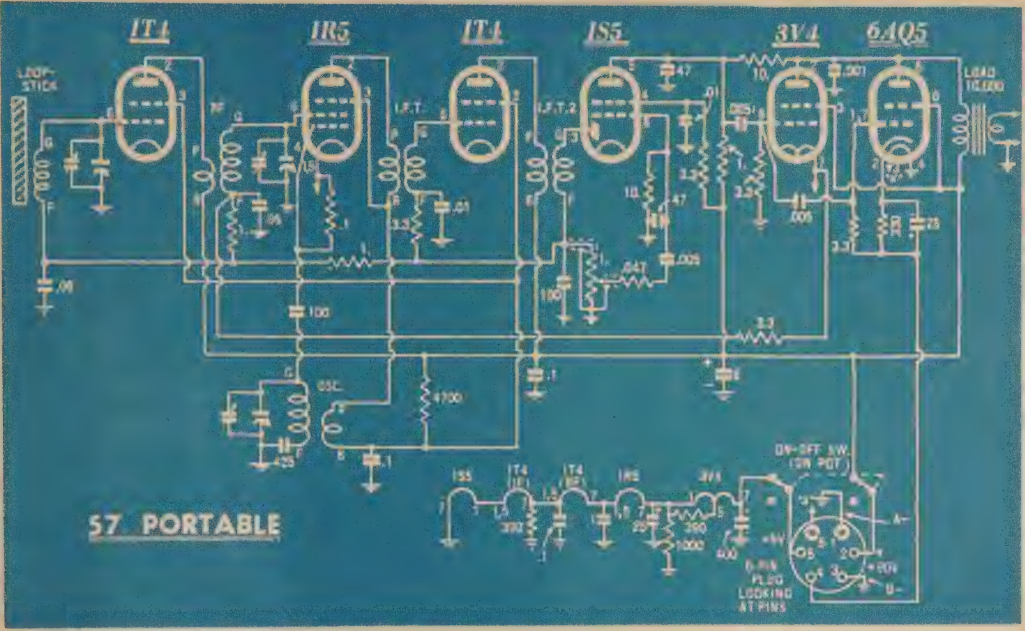
GRID BIAS

In a series network the valve filaments become progressively more positive with respect to earth. If the grids were simply returned, as usual, to earth potential, the positive filament voltage would be equivalent to a negative grid bias of the same order.

The circuit has to be manipulated, therefore, to give each stage its optium bias.

Looking at the AVC network, for

CIRCUIT OF THE SET HAS SOME UNUSUAL FEATURES



The receiver circuit diagram is conventional with the exception of the extra output stage. The filament circuit is shown separate to facilitate wiring.

example, it is obvious that a simple AVC line would be unsuitable, as this would constitute a common return path for the 1S5 diode and the three controlled grids. It could not maintain each grid initially at zero bias with respect to its own filament.

To overcome this problem; the AVC line is so arranged that the diode and each of the controlled grids is tapped along a high resistance divider, which steps the potential up at each feed point in the same ratio as the steps in the filament network.

AVC VOLTAGE

In this manner, with no signal input, the diode and each valve grid assumes a potential which is the same as that of its own negative filament pin, namely, zero bias. Note that the connections to the 1S5 are deliberately reversed to achieve this result.

With signal input, the diode generates an AVC voltage which is applied to the grids of the valves to be controlled. Notwithstanding some division of the AVC voltage, ample control is retained to avoid overloading.

Whether or not all readers understand the foregoing, extreme care must be taken to wire the filament network correctly.

Connection to batteries or power supply is made via a 6-pin plug and socket arrangement. In both cases the A-plus and B-plus leads are brought to the double pole switch on the potentiometer.

When wiring the socket for battery connection, make sure that the A-minus and B-minus are brought to the pins through individual leads. This avoids a potentially hazardous situation which can arise if a common A-minus and B-minus lead comes adrift.

No difficulty should be encountered in wiring the power supply. Even allowing for larger components than we used, there should be sufficient space.

Particular attention must be given to the wiring of the output socket and the corresponding plug on the receiver

PARTS LIST

1 Chassis 8½in x 5in x 1in.
1 3-gang (Roblan)
1 Dial type MSL/48 (H glass)
1 Broadcast RF coil (miniature)
1 Broadcast oscillator coil (to suit 1R5)
2 455 Kc miniature IF's
6 7-pin miniature valve sockets
1 5 x 7 oval speaker (10,000 ohm transformer)
1 Ferrite rod aerial
1 6-pin socket and cover
1 6-pin plug and cover
2 45-volt batteries (482)
1 9-volt battery (765)

VALVES
2 1T4, 1 1R5, 1 1S5, 1 3V4, 1 6AQ5

CAPACITORS
3 gang trimmers
4 .1 mfd 200V paper
2 .05 mfd 200V paper
2 .01 mfd mica or ceramic
3 .005 mfd mica or ceramic
1 .001 mfd mica or ceramic
2 100 pf ceramric
2 47 pf ceramic
2 25 mfd 40V electrolytic
1 8 mfd 125V electrolytic
1 400 mfd 12V electrolytic

RESISTORS
1 1 meg potentiometer with DP switch
2 10 meg ½ watt
5 3 meg ½ watt
3 1 meg ½ watt
1 .1 meg ½ watt
1 .047 meg ½ watt
1 1000ohm ½ watt
2 390 ohm ½ watt
1 4700 ohm 1 watt
1 330 ohm 1 watt

POWER SUPPLY
1 225 aside 50 ma power transformer
1 Filter choke (see text)
1 Noval socket
1 6-pin socket

VALVES
1 6V4

CAPACITORS
1 30 mfd 350V electrolytic

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1 2000 ohm 10 or 20 watt
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Without trying to argue about figures, it is possible to operate the power supply for hours on end and without excessive heat rise, the transformer becoming just comfortably warm to touch.

OUTPUT STAGE

The choke used was an 80 mA type but a 60 mA type should be adequate, provided its DC resistance closely approximates 300 ohms. A low DC resistance will avoid undue heat rise under the full load conditions.

Now a word about the output stage. As you will see from the circuit, we have included a second output valve. which is virtually connected in parallel with the normal 3V4. However, it can operate when its heater is supplied with power from the mains transformer.

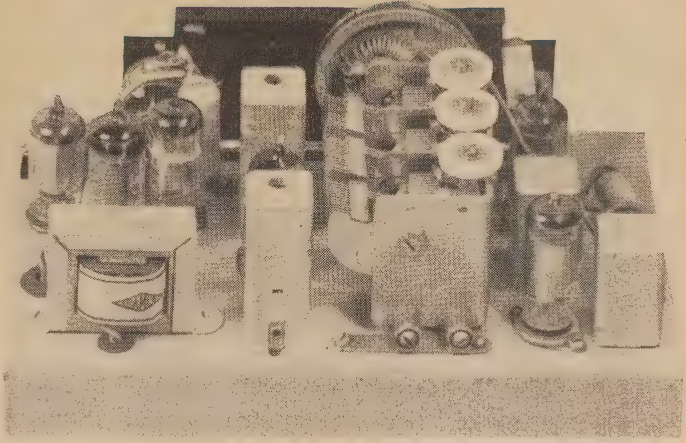
For the scheme to be of any use, it must provide a worthwhile increase in power output.

Reference to valve characteristics indicates that, with 90 volts on the plate and screen and a grid drive to match that of a 3V4, typical AC power valves would deliver a power output of not much more than a 3V4.

To deliver an output of at least twice that of the 3V4, and preferably more, the plate and screen voltages must be raised to about 120 volts.

However, since the plates and screens of the two valves are in parallel, it would mean that 120 volts would be applied to the 3V4 as well. This is out of the question.

GENERAL VIEW OF THE RECEIVER



A photograph of the receiver chassis, showing the placement of major components. The loopstick is not shown but its coil assembly is just visible, tucked away behind the oscillator coil.

We overcame the problem by allowing the centre tap of the transformer to assume a potential some 30-odd volts negative with respects to chassis, returning the cathode of the extra valve to this point. This provides an effective 125 volts between plate, screen and centre tap.

The 3V4, operating between B-plus and chassis, operates with an effective supply voltage of 90 or thereabouts, which is in line with the ratings.

The 6AQ5 proved to be the most suitable valve for this application, since with the correct selection of bias, its overload occurs simultaneously with the 3V4.

Under the above conditions and with a grid drive of about four volts the 6AQ5 is capable of delivering just on a watt of power—a worthwhile improvement.

Because of the feedback around the circuit the gain does not increase with the 6AQ5 in operation but the power output on peaks does—and this is where the average portable fails.

When the set is operating from batteries the 6AQ5 is completely inoperative and does not affect the 3V4 in any way.

The load for the two valves in parallel is not the optimum required, but it is a price one must pay for the extra advantages. In practice it is not likely to make much difference to the reproduction.

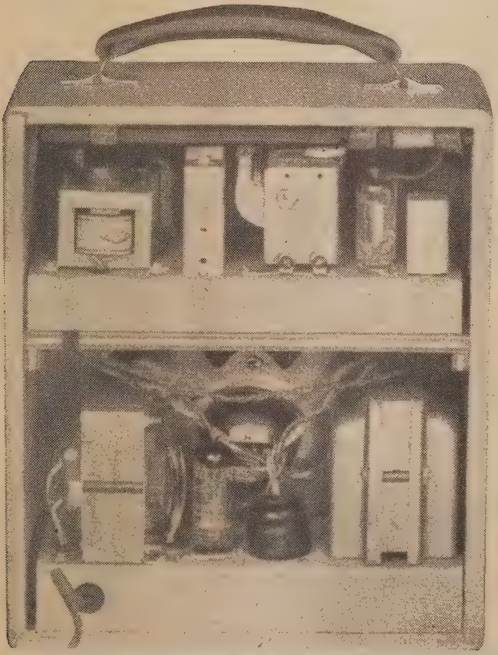
BIAS FOR OUTPUT STAGE

Bias for the 6AQ5 is obtained in the normal manner, the bias resistor being returned to the centre tap. Watch the polarity of the bypass electrolytic and the return point for the 6AQ5 grid resistor.

Coming to the actual constructional details, it will be seen that both the receiver and power supply chasses are easy to duplicate, consisting of simple bends.

We used 16-gauge aluminium, but 18-gauge aluminium or steel would do. Detailed blueprints will be supplied to the chassis manufacturers and will be available through our query service for those who wish to make their own.

Having obtained the chassis, the first job is to mount the major components, commencing with the tuning gang and dial.



A rear view, showing the receiver and power supply chassis in place. The loopstick is just visible under the top portion of the cabinet. Note the connecting cables to power supply and speaker which pass through a slot cut in the shelf. Changing over from batteries to AC unit is simply carried out by removing plug from the battery socket and plugging into the power supply chassis.

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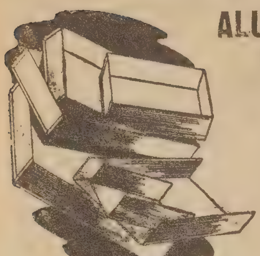

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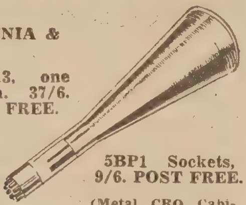

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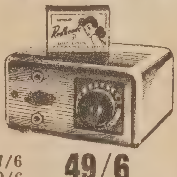

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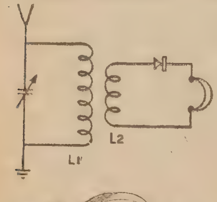

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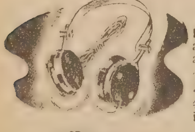

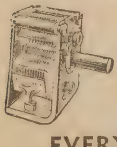

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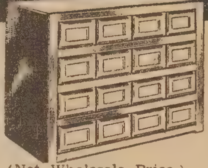

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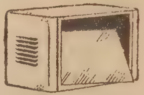

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The dial is an MSL/48 type and normally comes with the drive spindle on the right-hand side. This must be transferred to the left-hand side prior to fitting. Memorise the method of fitting the dial cord, as this will save one's temper being frayed.

DIAL MOUNTING

The dial is mounted to the underside of the chassis in a suitable cutout. It is stood off by means of half-inch spacers or threaded pillars. The dial glass retaining clips should be flush with the front edge of the chassis.

To facilitate the mounting of the gang the rear bracket is stood off with spacers, the front bracket being mounted flush.

The dial drum is normally attached to the rear of the dial by a centre screw. This should be removed and the drum locked on to the gang spindle.

Next, mount the valve sockets, taking care to orientate these correctly. This will ensure the shortest possible connections, while keeping the layout neat.

Looking over the rear edge of the chassis, mount the RF valve socket with the gap in the pins facing to the rear right, with a solder lug under the rear nut. The IR5 socket has the gap facing directly the right-hand end of the chassis, with a solder lug under the front nut.

SOCKET ORIENTATION

On the IF amplifier socket the gap faces to the rear left-hand end of the chassis, with a six-terminal mounting strip under the rear nut, running at right angles across the chassis.

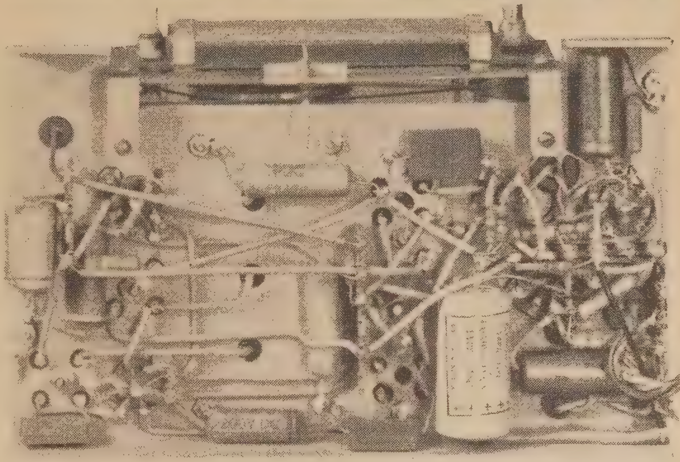
The gap on the IS5 socket faces directly to the rear end of the chassis, with a solder lug under the rear nut.

The 3V4 socket has the gap facing the front left-hand end of the chassis, with a solder lug under each of the mounting bolts. The gap on the 6AQ5 socket faces to the rear right-hand end, almost at right angles to the right-hand side.

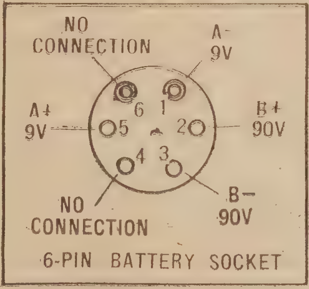
Coming to the coils and IF transformers the RF coil is mounted with the plate and B-plus pins facing the front edge and the oscillator coil with the grid and B-plus pins also facing the front.

The IF transformers used are the side-mounting type and are mounted in a front-to-rear direction, with the grid and B-plus pins of the first and second IFs facing the front of the chassis. A solder lug is placed under the front nut of the second IF.

PHOTOGRAPH SHOWS THE LAYOUT



This under-chassis view of the receiver illustrates the simple layout. Some crowding may be experienced in the audio section, but using miniature components, there is enough room to fit everything in.



Here are wiring details of the battery plug. Do not be tempted to use a common A-minus and B-minus lead.

At this stage you may go ahead with the wiring, the first job being to earth the centre spigots of all the valves to their nearest earth lugs. If a steel chassis is used it is advisable to connect the earth lugs by a common lead, in case rust or corrosion should cause a bad earth. Twenty or 22 gauge tinned copper wire should be ideal for this purpose.

FILAMENT WIRING

The filament wiring may be attempted next, taking the necessary precautions to wire this correctly, for reasons discussed previously.

Where pins 1 and 5 are shown connected in the diagram, leads may be soldered to either one, as they are internally connected in the valve. Do not, however, use the remaining lug as an anchor point for some other part of the wiring or something drastic may happen.

We used spaghetti-covered 20-gauge tinned copper wire for the wiring runs, but ordinary hookup wire will do. Most of the leads between socket pins and the coil and IF transformer lugs may be run directly, orderly appearance being preserved by keeping the small components on the square.

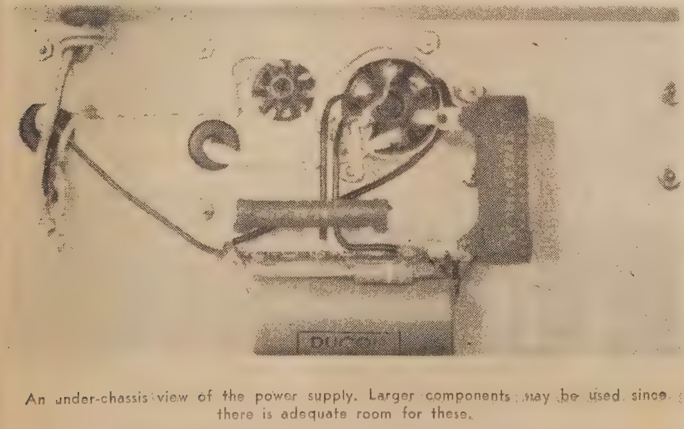
SOLDERING HINTS

Needless to say, the iron tip must be kept scrupulously clean and tinned at all times to prevent shorting anything with blobs and whiskers of solder around the miniature lugs.

A layout diagram of the crowded audio section has been prepared and this should facilitate the fitting in of the various small parts.

When purchasing the parts, make sure to order the smallest possible, as this will make a difference to the ease with which the set can be wired.

Due to limited space some of the audio wiring is completed above the chassis, which is really a good scheme as it ensures the shortest possible leads for the components grouped around the volume control.



An under-chassis view of the power supply. Larger components may be used since there is adequate room for these.

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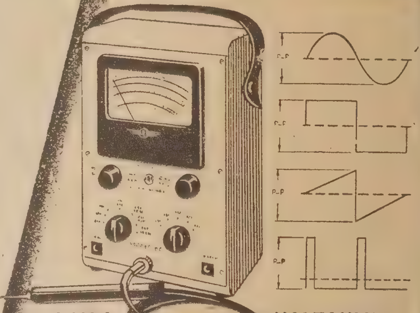
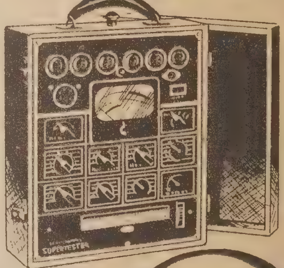


A.W.A VOLTOHMYST



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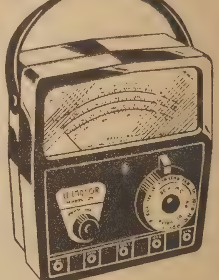
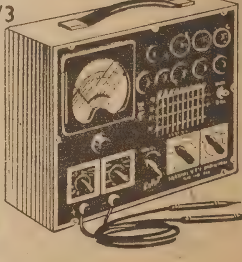


TAYLOR
71

PALEC
VCT/3



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To anchor these components use is made of a modified seven-lug strip. The earth lug is anchored by the forward-facing socket mounting bolt, and the excess overhang over the side of the chassis is nipped off as far as the earth lug. This will leave a total of four lugs, one of which is the earth lug.

The components so mounted are the .047 meg resistor, in series with moving arm of the potentiometer, the .005 coupling capacitor and the 47 pf RF bypass.

The 8 mfd electrolytic is likewise mounted above the chassis, between the B-plus lug on the receiver side of the switch and a suitable earth point. The earth lug on the mounting strip is also used as the anchor point for the A-minus and B-minus leads.

The outgoing power leads from the switch pass through a grommeted hole in the chassis which is between the 3V4 and the output transformer. This is joined by the 6AQ5 heater and cathode leads. The completed cable eventually passes through a slotted cutout in the shelf on its way to the power source.

ALIGNMENT PROCEDURE

Alignment procedure is quite standard and has been discussed in past issues Readers not familiar with this or those not possessing the right issues may procure a reprint of the article through the query service.

While on the subject of alignment it is worth mentioning the method used for adjusting the loopstick. The adjustment is made at the low frequency end of the band, as with the cores of standard coils.

The coil is adjusted along the length of the rod for maximum output. The receiver is then tuned to the high frequency end and the trimmer across the aerial section of the gang is adjusted for maximum output.

Now for a word on the cabinet. A detailed drawing has been prepared, showing the major constructional details. The sides, top, bottom and shelf are made of 3/8 ply, whilst the rear and front portions are of 3/16 ply.

CABINET DETAILS

Commence by marking and cutting out the side, top, bottom and shelf pieces. Allow about 1-8in for planing. Use your square freely to ensure perfectly square edges and corners.

The two wide pieces may be placed in the vice and planed simultaneously. The top, bottom and shelf may be treated in like manner.

The next step is to assemble the pieces already cut, with the exception of the shelf. Use glue and panel pins and, prior to finally fixing them in place, check for squareness of the joints and corners.

While the work completed so far is drying, mark and cut out the front and rear panels, allowing about 1-16in overlap all around for the front panel.

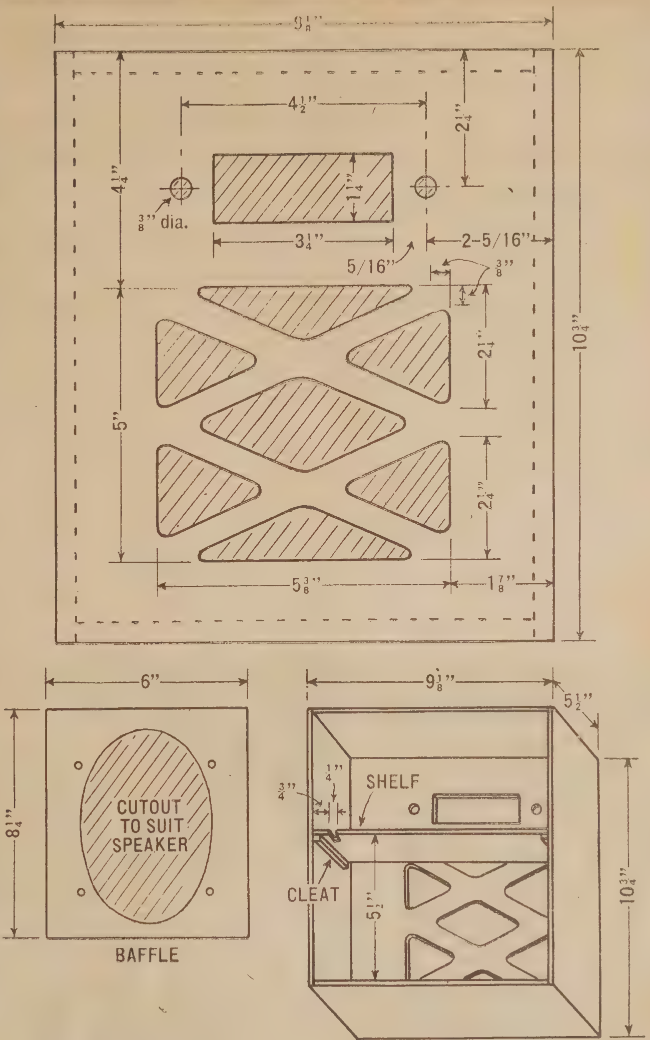
The fretwork on the front panel may then be cut out, care being taken to align the dial cutout and spindle holes correctly, or difficulty will be experienced later in the final fitting of the receiver chassis.

Having cut out the fretwork, proceed to attach the front panel to the work completed so far. When this step is complete, do not attempt to plane or sand off the surplus, rather put the work aside for the glue to set.

The rear panel will require a small cutout for a power cord outlet, in the lower left-hand end. It will be wise at this stage to cut out the baffle and the slats on which the shelf rests. These slats are fixed to the inside walls of the cabinet by means of glue and panel pins.

If the slats are not cut to the full width of the cabinet sides, it should be possible to slide the baffle in or out when the slats and the shelf are permanently in place.

The cabinet can be sanded, filled and lacquered if desired. However, for a portable set, leatherette covering seems more appropriate and durable.



TOP, BOTTOM & SIDES
3/8" PLY. FRONT PIECE
& BAFFLE — 3/16" PLY.

SHELF IS 8 3/8" BY 5"—3/8" PLY, MOUNTED ON 3/8" SQUARE CLEATS WHICH ARE APPROX. 4 1/2" LONG TO ALLOW EASY WITHDRAWAL OF BAFFLE WHEN SHELF IS FIXED IN PLACE. BACK SHOULD BE 3/16" PLY WITH SUITABLE CUTOUT FOR POWER CORD. MOUNT WITH HINGES ON ONE SIDE OF CABINET AND CLIP ON THE OTHER SIDE.

Constructional details for the cabinet. The speaker is fixed to the baffle by means of countersunk bolts. Allowance is made for its easy withdrawal.

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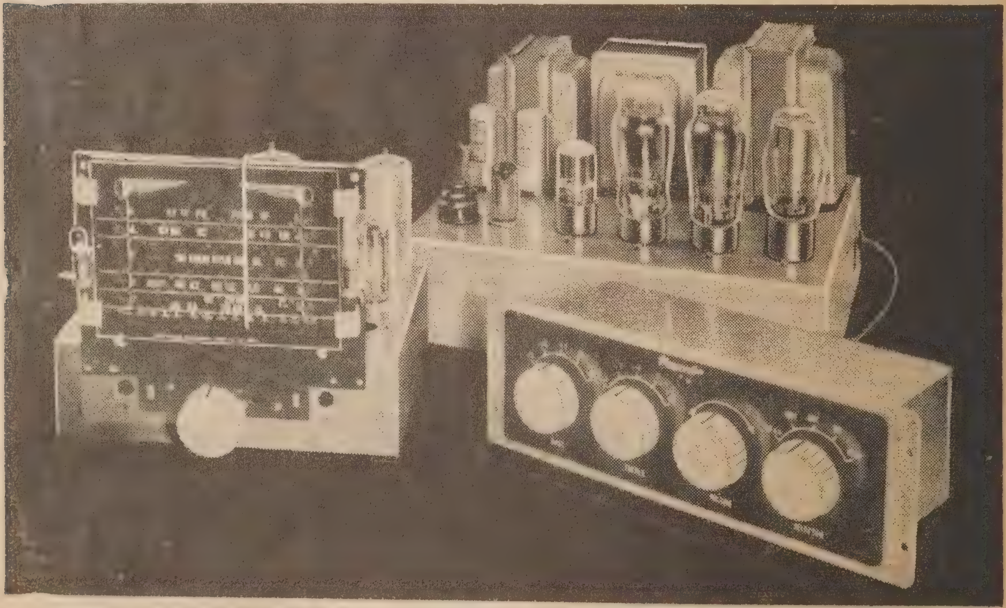

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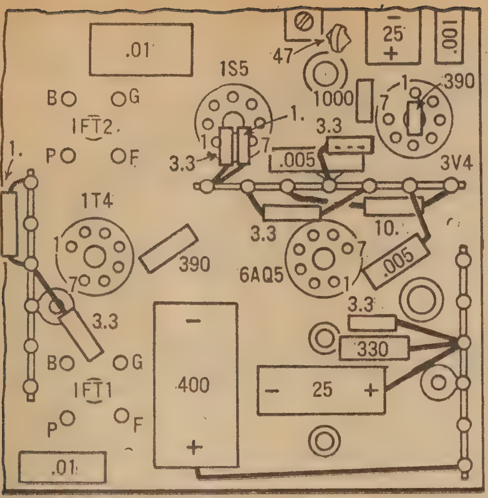


This layout diagram of the crowded audio section should help readers to duplicate our layout.

No great aptitude is necessary for working with leatherette. Careful marking out and cleanliness will ensure a neat appearance. The whole cabinet, with the exception of the lid, is covered with a single piece.

Cut a rectangular sheet, whose dimensions include the height and width of the cabinet, plus the width of the sides, top and bottom, including their thickness and an approximate ½in overlap.

Next cut squares from the corners, so that when the top, bottom and side pieces are folded over, their edges are parallel. Allow a small amount of overlap. All measurements and cutting is to be done on the inside face of the leatherette.

We used cold water glue for all the gluing operations. Spread some glue, using a brush, on the front panel and on the corresponding face of the leatherette. Lay the leatherette in place, taking care to align the corners, then reverse the work and proceed to rub out the wrinkles and air bubbles, using a clean rag.

When the front face is perfectly smooth, the same process is repeated with the sides, top and bottom of the cabinet, including the overlap, which goes over the edges on to the inside face of the cabinet.

Overlap on the corner edges is treated in like manner. When the wrinkles and air bubbles have been ironed out, cut through the overlap on the corner edges, using a straight-edge and razor. The remaining edges should now butt perfectly.

While this is drying, the rear piece may be covered, using the method described above.

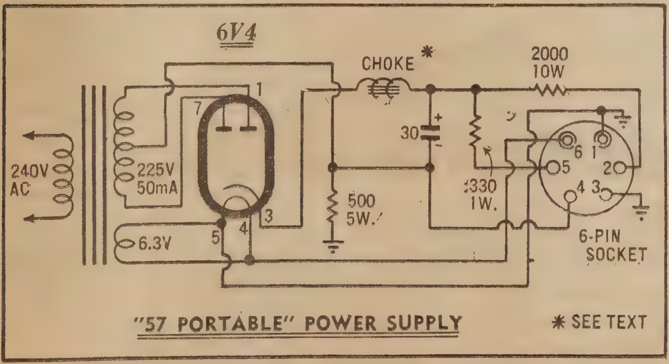
A further step to completion of the work is to cut the leatherette over the fretwork and dial cutout, so that it may be folded over and glued on the inside face of the front panel.

The final step is the fitting of the speaker grille cloth on the inside of the speaker fret. This may be glued on or tacked on, using very fine tacks. Then fit a leather carrying handle and rubber feet.

It now remains to hinge the rear panel to the cabinet, after which the speaker and receiver may be installed. The shelf may be glued in place or retained by countersunk screws, whilst the receiver chassis is held by a bolt, which goes through the chassis and is retained by a nut on the inside lower face of the shelf.

The top edge of the baffle is held in place by the shelf, whilst the bottom edge may be anchored by a suitable cleat.

(Continued on page 127)



The power supply circuit calls for little comment. Care must be taken in wiring the output socket correctly, also watch the return point of the electrolytic.

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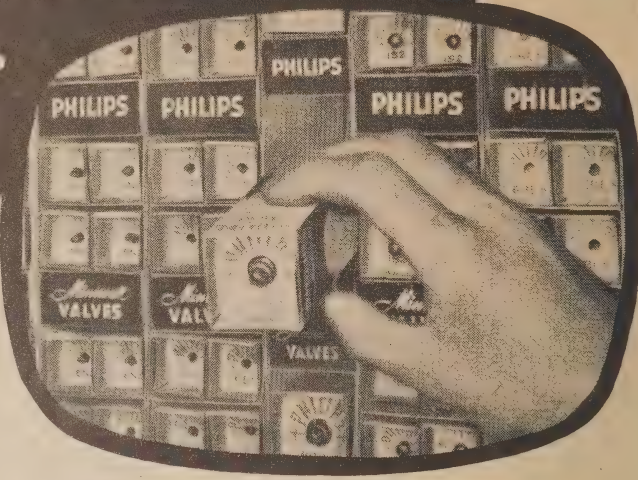

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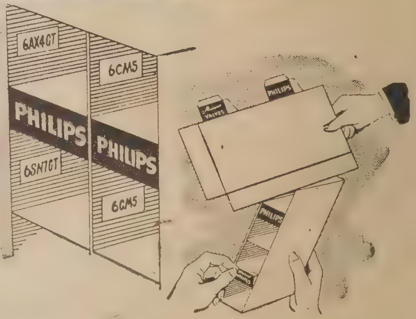

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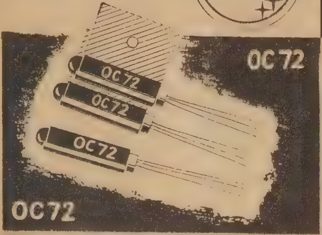

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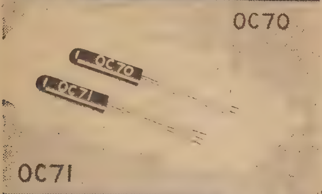

OC70 All-glass p-n-p junction transistor in all-glass construction for medium gain low power audio frequency applications, and for use in switching and oscillator circuits.

OC71 Junction transistor of similar construction to OC70 but intended for use in high gain low power applications up to 300 Kc/s and for switching and oscillator circuits.

LIST PRICE
27′-
each

OC65
OC65
OC66
OC66

OC65 *Miniature* medium gain transistor intended for medium gain low power audio frequency application up to 25 mW and as a low noise oscillator and in switching circuits where large signals are involved.

OC66 *Miniature* p-n-p transistor for high gain low power amplifiers finding application in miniature equipment at frequencies up to 300 Kc/s in common base configuration. The electrical performance is similar to that of the OC71.

LIST PRICE
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OC73 *A 50 mW* junction transistor in all-glass construction. Due to its close tolerances, this transistor is particularly suitable for use in professional equipment. For general use as amplifier, oscillator and for switching applications at frequencies up to 500 K/cs.

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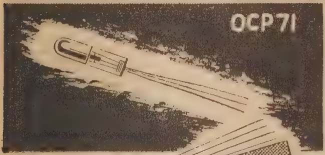

OCP71 *Photo Transistor* of p-n-p alloy in all-glass construction. This type has extremely high sensitivity, and may be used to operate a relay direct without amplification.

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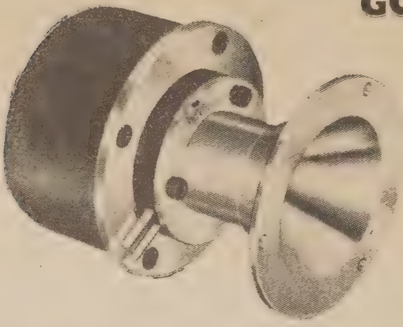

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Trebax is a new high efficiency pressure driven reproducer covering the treble register in multi-channel High Fidelity systems. The frequency coverage is achieved with complete freedom from irregularities in response. The efficiency of TREBAX is such that it may be used with the most efficient bass and mid-range units.

SPECIFICATION

FREQUENCY RANGE	2,500 c.p.s. to 16,000 c.p.s.
IMPEDANCE	15 ohms at 10 Kc/s
SYSTEM POWER HANDLING CAPACITY	25 watts
CROSSOVER FREQUENCY	5 Kc/s.

MIDAX MID-RANGE PRESSURE DRIVEN HORN UNIT

This entirely new reproducer is designed for high efficiency low distortion coverage of the middle register in multi-channel high fidelity systems.

It consists of a pressure driver and horn unit designed to cover a total frequency range of 400 c.p.s. to 8 Kc/s.

The efficiency of Midax is such that it can be employed with any direct radiator up to 18 inches in diameter.

SPECIFICATION

FREQUENCY RANGE	400 c.p.s. to 8 Kc/s.
IMPEDANCE	15 ohms at 400 c.p.s.
SYSTEM POWER HANDLING CAPACITY	25 watts.
CROSSOVER FREQUENCY	750 c.p.s. and 5,000 c.p.s.

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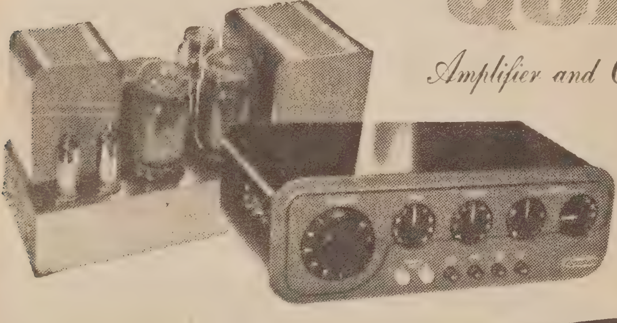
QUAD II

Amplifier and Quality Control Unit



BRIEF SUMMARY OF FEATURES:—

- * *4 input sockets each selected by push buttons covering connection to microphone and radio (or two radios), tape recorder and gramophone.*
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Enthusiasts the world over are expressing their approval of the QUAD 11 Amplifier—whereas we don't go so far to say the QUAD 11 is perfect, we do claim that it is the best which present techniques can devise. The design of the QUAD 11 is simple and straightforward, without the sacrifice of a single refinement capable of contributing to the final objective.

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AUDIOM 70

AUDIOM BASS LOUDSPEAKER

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SPECIFICATION

	AUDIOM 60	*AUDIOM 70*	*AUDIOM 80*
FLUX DENSITY	*14,000 GAUSS*	*17,500 GAUSS*	*14,500 GAUSS*
BASS RESONANCE	*35 c.p.s.*	*35 c.p.s.*	*35 c.p.s.*
POWER HANDLING CAPACITY	*15 watts.*	*20 watts.*	*25 watts*
IMPEDANCE AT 400 c.p.s.	*15 ohms.*	*15 ohms.*	*15 ohms.*

TWO-WAY SYSTEM

AXIOM LOUDSPEAKER USED AS MID AND BASS-RANGE UNITS

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- * *Facilities for providing alternative playback characteristics for different makes of record.*
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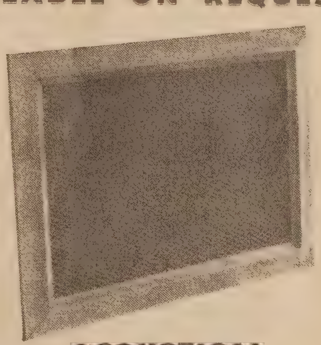

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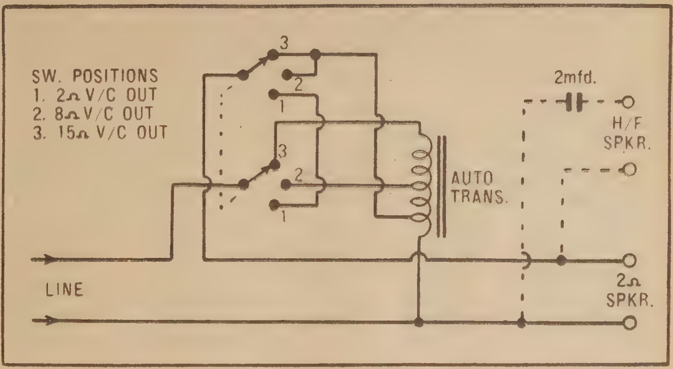
A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

ARRANGEMENT FOR MATCHING SPEAKER V/C IMPEDANCES

A reader from Glebe, N.S.W. submits for this month's issue a solution to his workshop problem of a "Universal" and "portable" speaker, having the facility for matching the different output voice coil impedances of equipment under test or repair.



OUR correspondent writes that the idea first occurred while reading our article on "Filters And 2-Ohm Voice Coils" featured in the September, 1952, issue of R, TV & H.

In this article we discussed the means of winding a simple auto transformer for matching a 15-ohm top-cut filter to a 2 or 8-ohm speaker.

With this type of transformer it is possible to adapt it to match correctly a 2, 8 or 15-ohm output line impedance to a speaker with a voice coil impedance of any one of these three values.

The original transformer was wound on a discarded speaker transformer core with a ¾in square centre leg

A NEW WINDING

With the old winding stripped off, a new winding was installed consisting of 137 turns of 19 B & S enamel wire with tappings at 50 turns for 2-ohm voice coils and at 100 turns for 8-ohm voice coils. It was layer-wound and insulated with notepaper between layers.

Tests on this transformer showed up its main limitations in the power handling capacity, the working maximums being in the order of 6.5 watts at 50 cps and 3.9 watts at 30 cps.

To be on the safe side and, at the same time improve the response, our contributor decided on a winding with the same number of turns but, used a larger dimensioned core and a larger gauge of wire to fill the available window space.

He mentions the size of the transformer core having a 1in square centre leg and just managed to instal a winding of 17 B & S gauge enamel wire.

He then worked out a suitable switching arrangement which would allow his 2-ohm workshop speaker to be used for testing and repairing equipment with other speaker voice coil output impedances.

The arrangement is simple enough, using a two-pole three-position switch connected in one line lead for impedance selection, the second line being a common lead.

As can be seen in the accompanying diagram the line input is switched across the auto transformer for 15 and 8-ohm voice coil outputs. At the same time, the second switch pole selects the 2-ohm tapping of the auto transformer for the test speaker.

However, for a 2-ohm voice coil output, the auto transformer is not needed and is switched out of the circuit. The line leads, as per the diagram, are then so arranged as to connect direct to the speaker.

By interchanging connections to the switch and transformer, this arrangement can be made to apply with test speakers of 8 or 15-ohm voice coil impedances.

SPEAKER BAFFLE

For a suitable "portable" baffle, our reader then decided on an old desk top measuring approximately ¾in thick and 2ft 6in wide by 3ft 6in high when standing in its intended upright position.

To make it more serviceable, he attached with screws lengths of timber 4½in by 1in, edge on to the top and sides. To the bottom edges, strips of wood of suitable length and thickness were mounted to act as feet and to stand the baffle upright.

To enable easy shifting of the baffle around the workshop, he also mounted carrying handles to the sides at a suitable height, thus permitting the unit to be picked up when it was necessary to move it.

The desk top was in two pieces and, although dowelled and glued together, to strengthen it, he mounted across the inside, a piece of dressed 3in by 2in approximately 15in up from the floor and attached with screws.

The 12in speaker was mounted above this cross bar, bringing it to a good listening height a little above the centre of the baffle.

He mentions at this stage that, having sufficient space, as an afterthought, he also mounted a spare 5in high frequency speaker above the larger one. These speakers were later connected in parallel with a 2 mfd. capacitor in series with one of the leads to the "tweeter".

The cutout for the 12in speaker was made with a "keyhole" saw. However, for the smaller speaker cutout, according to our correspondent, it was easier to work with a wood chisel and finish with a half-round wood rasp.

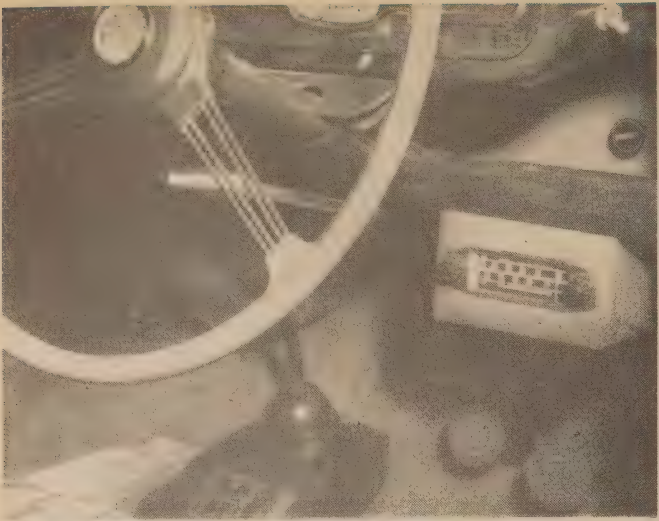
A hole was drilled for the switch above the two speakers and the inside of the baffle was routed around this hole to inset the switch.

At this stage, the speakers and switch were removed and the baffle given two coats of grey enamel to match other equipment. When dry, the switch positions were suitably marked on the front in white and labelled 2, 8 and 15.

AUTO TRANSFORMER

The auto transformer was screwed down to the inside of the baffle and to one side of the switch, together with a tag strip to act as an anchor point for the common line. All other connections were made direct to the switch.

Our correspondent concludes by saying that for a line he used a fairly long length of 2-core plastic flex. When the baffle was not in use this lead was wound around two small wire reels mounted inside the baffle.



A typical installation in an Austin A-40. The tuning controls are conveniently located for the driver and there is still ample leg room. The speaker is mounted on the bulkhead (visible behind the gear lever) but could also be mounted in the space provided above the windscreen.

HOW TO INSTAL YOUR KARSET

Here is the third and final article on our latest Karset—how to instal it in your car. This is a job calling for a fair amount of attention to detail and the data we have collected over the years should prove invaluable to those who may be undertaking this job for the first time.

by Philip Watson

UNFORTUNATELY no one can say with any degree of certainty how much work is likely to be involved in any particular case. Cars can be notoriously unpredictable in this regard and it would be foolish to deny that some can be particularly difficult.

On the other hand, the great majority will respond to a fairly well established routine and the chances are favorable that this is all that will be needed. If not you will still find it worth while to devote some extra time to trying the various modifications we suggest.

The installation may be considered under three separate headings: The best place to mount the receiver, power supply and speaker; the best type of aerial and method of mounting; the suppression of interference.

RECEIVER POSITION

First, the best spot for the receiver, etc. In many cars there is a space already provided for a radio, usually about the middle of the dashboard and so arranged that the set can be accommodated behind it with the dial visible through the cutout provided.

With this method the rear of the receiver case is usually supported by means of a strap fastened to the bulkhead as high as possible above the set. If the receiver and vibrator case are fastened together the same method of mounting may be employed, assuming there is room for the longer assembly.

If this position can be used it has much to recommend it. It is readily accessible for tuning by either the driver or the passenger, it does not encroach on "leg room" or other valuable space and it is generally the most pleasing arrangement aesthetically.

If for any reason it cannot be used there are several alternatives. The set may be hung from the underside of the parcel tray or from the underside of the dashboard. The exact location will depend to some extent on personal choice, but remember that ease of operation for the driver is an important consideration.

There are several alternatives for the power supply position, such as combining it with the receiver, mounting it on the bulkhead nearby, or in some section of the engine compartment on the other side of the bulkhead. In some cars, such as the early Austin A70, there is a compartment set aside for the radio near the battery. While this was intended for a complete set, operated by Bowden cables, there is no reason why the power supply cannot be housed in it.

Another car which lends itself to this idea is the Renault, since it has only a luggage compartment on the other side of the bulkhead. All else being equal, the distance and length of lead between the two units should be kept as short as possible to minimise voltage drop in the cables.

Regardless of where the set is mounted, it is normally necessary to bond it carefully to the body of the car. This is a precaution against both ignition and vibrator interference.

Along with the set we must also consider the speaker. Ideally this should be the largest that can be conveniently accommodated — a fact which is not always fully appreciated. Although the modern motor car is an amazingly quiet device in which the passenger is hardly aware that an engine exists, the fact remains that the overall noise level cannot be ignored.

Such motor noise as there is, plus the whine of the tyres, plus the rush of wind past the body, all add up to quite a substantial "masking" level—to give it its correct technical name.

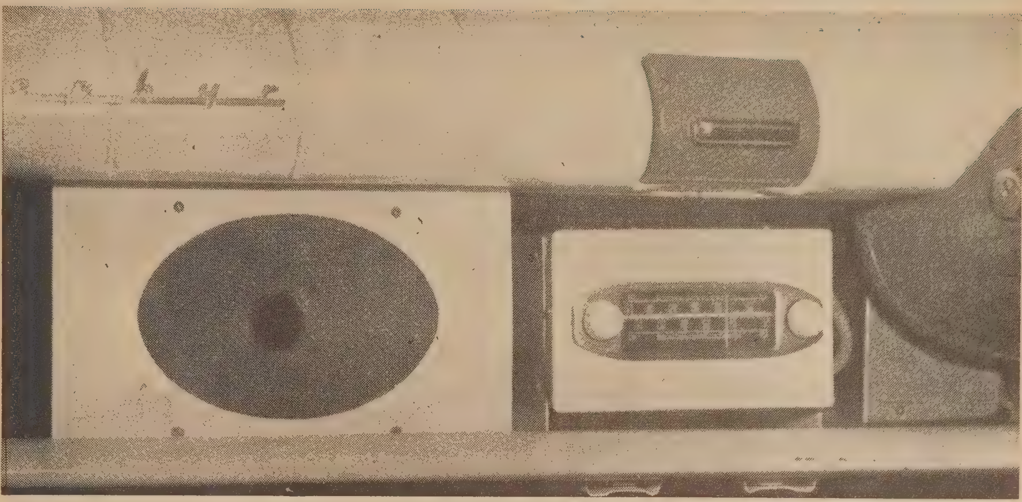
MASKING LEVEL

This masking level is often of such an order that a five-inch speaker may easily be pushed close to its limit in order to deliver enough volume to override it. A larger speaker scores in two ways: it can deliver a greater volume before reaching the limit of its suspension system, and it is more efficient, meaning that there is less chance of overloading the output stage in an effort to provide sufficient volume.

In view of the above, a five-inch speaker should be regarded as the absolute minimum. Unfortunately, there is the greatest temptation to use a small speaker in a small car — the very place where one may reasonably expect the noise level to be highest.

If possible, therefore, try to find space for something larger, such as a six-inch, or, better still, one of the oval types. These are very useful when the speaker has to be fitted into awkward places and are very popular for car use.

This brings us to the question of just where the speaker is to be mounted. All



This installation in a Zephyr can be imitated with most cars having a parcels tray. The receiver is fitted with side brackets and bolted to the shelf. The power supply can be tucked in near the steering column where space is not normally used for other purposes. The speaker, mounted as shown or across the left hand corner sounds well and has good distribution. The set could also be hung from the brackets below the shelf but is not then so accessible.

things considered, the best place appears to be behind the dashboard grille, particularly if the latter has been designed for this purpose.

As with the set, this position conserves space, is aesthetically pleasing, and, most important, is good acoustically for both front and rear seat passengers. A further advantage is that the speaker can be mounted on a simple baffle and does not require its own housing box.

A position which is frequently used, mainly due to space limitations, is on the bulkhead beneath the dashboard or parcel tray. However, it is far from an ideal arrangement, a lot of signal being lost before it reaches the listeners, particularly those in the back seat. It also means that a box must be provided for the speaker.

Another arrangement is to mount the speaker above the windscreen in the header bar. This is a good position acoustically, but it is often difficult to accommodate a reasonable size speaker without making the unit too obtrusive. One must be careful, too, about disfiguring panel work and lowering the resale value of the car.

SPEAKER MOUNTING

Some cars, such as the early Austin A-40, had a space and cut-out for a five-inch speaker already provided in this position. A better approach might be to use an oval speaker, such as a 5-7 type, modifying the cut-out accordingly. However, make quite sure the speaker you select will fit in the available space.

Some of the more expensive English cars even had speakers built into the bodywork. One such was the Austin Sheerline, which had two speakers, one in the conventional position behind the grille, and the other beneath the shelf behind the rear seat. Acoustically, this arrangement is excellent, particularly in a big car where the rear-seat passengers may not hear the main speaker to best advantage.

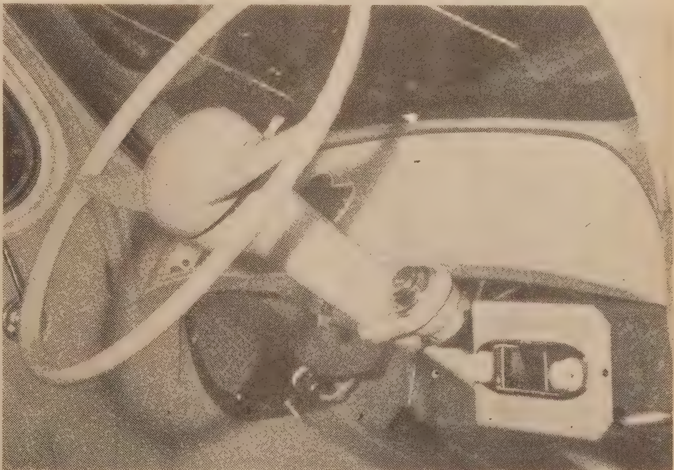
Summed up, one should try to select the most favorable acoustic position, but keeping in mind the need to use a reasonable size speaker. Thus, a 7-9-inch oval speaker behind the dash would probably be better than five-inch round above the header bar. On the other hand, the latter may be better than an eight-inch round on the bulkhead.

Over all, of course, is the need to make the installation as unobtrusive and economical of space as possible.

Next the aerial. There have been a wide variety of aerials used over the years, the fashions changing with the styling of cars or simply at the whim of the public. At one time the tendency seemed to be to hide the aerial if this was at all possible, and it was frequently built into the fabric tops of the early sedans.

The Ford V8s of the mid-30s were typical examples, the aerial taking the form of a wire mesh or screen concealed under the fabric trimming. The lead-in was brought down through the windscreen pillar ready for use whenever a radio was installed. A similar arrangement is used in the later Ford V8 Pilot.

These aerials were quite efficient, prac-



Even a baby car can accommodate the Karset. Here it has been fitted to a Renault, the set being supported in a convenient position under the dash. The speaker can be seen on the other side of the glove box, while the vibrator supply is in the front luggage compartment.

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PAGE 1

"Q-PLUS" PRE-FAB TUNING UNIT TYPE TWR5

A triple wave and gramo tuning unit, pre-wired and pre-aligned.

SWITCH POSITIONS

1. (Max. anti-clockwise) = pick-up consisting of 3 sets contacts on reverse side of each switch wafer.
2. 535 Kcs.—1630 Kcs = B/C.
3. 2.8 Mcs.—8.0 Mcs. = Medium.
4. 7.5—23.00 Mcs Short Wave Band.

Chassis Mounting.—The unit is designed to fit, on the right-hand side of a chassis with the IF transformers and valves running along the back to the audio and power sections which are adjacent to the unit.

A cut-out 6in x 5in is necessary (5in deep commencing right at the front of the chassis) and 6in long. 4 holes with centres 4½in and 6¾in apart respectively will accommodate the prefab. unit, which comes with rubber mounting grommets.

Valve Types.—The TWR5/1 unit requires the addition of 1 type 6BA6 valve and 1 type 6AE8.

Dial.—The EFCO dial type no. USL46 is designed for use with this unit

Wiring Code.—From back hole nearest corner.
Blue = IF plate.
Red = B+ 250 volts.
Green = AVC supply.

From back hole near middle.
Green = Filament supply 6.3 volts, other lead through earth.
Red = Screen supply. • See later note.
Red lead from front near switch = Aerial.

PAGE 2

"Q-PLUS" PRE-FAB TUNING UNIT TYPE TWR5

SENSITIVITY.—With one stage IF amplification sensitivities of less than micro-volt were obtained on the B/C band, whilst the sensitivities on the other band were as follows:—

Medium band.

3.00 M/cs. 2 uV.
5.00 M/cs. 1.5 uV.
8.00 M/cs 1.2 uV.

Short-wave band.

8.2 M/cs 4 uV.
14.0 M/cs. 2 uV
21.0 M/cs. 2 uV.

Alignment.—As previously remarked the alignment of this unit is complete and no further adjustment should be necessary

IF Types.—In the standard size "Q PLUS" IF 8 and 9 or in the miniature size "Q PLUS" 41 and 42 are the most suitable types.

Screen Supply.—Recommended supply is from 250 volt B+ source through 30,000 W. 2-watt resistor. + bled by 30,000 W. 1-watt resistor. See circuit.

N.B.—A separate screen supply source is needed for IF channel.

tical tests indicating that there is little to choose between them and the present whip types. So, if you have a car of this type, there is little point in incurring the expense of another aerial.

Another early type was the underslung aerial. This consisted of a couple of rods mounted underneath the running board — in the days when there were running-boards — or under the car itself. Pickup was only fair, and the fact that they were exposed to possible damage and the collection of mud and grease was very much against them.

The advent of all-steel bodies and a more general acceptance by the public of the idea that an aerial was an acceptable accessory led to various forms of external aerials. After passing through a phase of fancy rooftop styles often attached by means of rubber suction cups, designs have settled down to a fairly standardised group of whip aerials.

EXTENSIONS

All are based on the telescopic principle, it being found that there is usually enough pickup for local listening without extending any of the sections. However, out in the country, the pickup is improved markedly by extending the aerial to its limit.

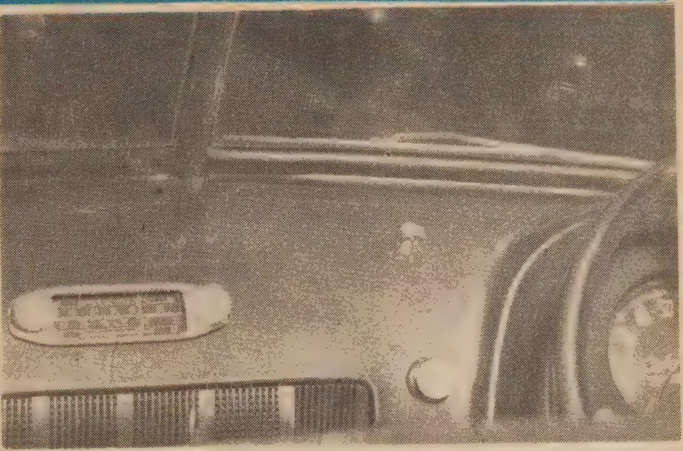
Two lengths are normally available, one about five feet and one about eight feet. The extra length often makes a worthwhile difference, particularly if an appreciable portion is below the body line of the car, where it intercepts little useful signal.

The simplest design is the top mounting cowl or fender type. It is intended for those cars which, by reason of the cowl or fender design, allow the aerial to be mounted on top of it without obscuring the driver's vision. This latter consideration is a most important one, the presence of even the slim rod proving distracting to a dangerous degree.

At the same time it is desirable that the aerial be mounted on the driver's side in order that he may raise or lower it with a minimum of inconvenience.

Where these requirements cannot be met by the top-mounting type, a side-mounting variety is the logical choice. These are mounted on two stand-off insulators attached to the side of the body usually about in line with the windscreen pillar. A variety of insulator shapes and sizes is available to accommodate most of the body shapes of current and recent cars.

SET MOUNTS BEHIND THE DASH

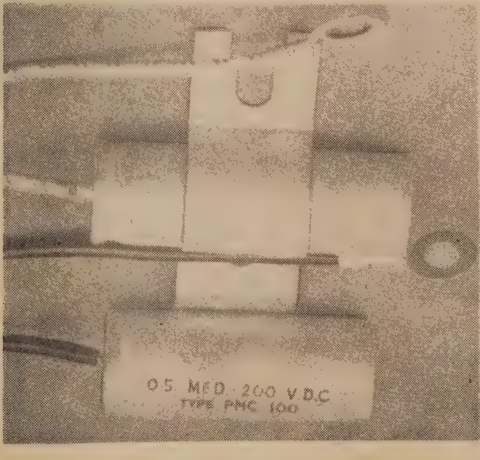


One of the most popular installations—in a Holden. A cut-out is provided in the dash (normally covered by a dress plate) and the set mounts conveniently behind it. The speaker is behind the grill just below the dial, mounted on a simple baffle. The set and power supply are bolted to a bracket which then fastens to the bulkhead. Slots in the underside of the cases allow exact positioning of the units. The front plate may be left off the set, and the dial supported with wooden blocks screwed to the inside edges of the case.

The third type is an above-the-windscreen mounting. It is most suitable for cars specially designed for this type and is less popular than the other two types. Typical of the cars on which it can be used are the Morris Oxford, Wolseley and Standard Vanguard.

The mounting position is central above the windscreen, and the aerial normally slopes backward at about the same angle as the windscreen. A control shaft passes through the body work to the inside of the car and is terminated with a suitable control knob. The purpose of this is to allow the aerial to be swung down and to one side whenever there is danger of its striking an obstruction, such as a garage doorway.

The lead-in is picked off at this point and runs via the windscreen pillar to the set. In cars equipped for this type aerial a drawcord is normally provided to draw the lead-in through these channels. In some cases the assembly of these aerials is quite tricky, and many home-builders may prefer to use one of the simpler types.



Two metal clad by-pass capacitors designed for use in car electrical systems. Note the mounting lug fastened to the body and which forms one side of the circuit. Normal rating is .5 mfd at 200 volts.

Regardless of the type of aerial selected, it is necessary to use a low-loss shielded lead-in to guard against ignition interference. Coaxial cable, such as type PT1M, is ideal for this purpose. It is most important that the shielding be bonded to the car body at the base of the aerial and to the chassis of the receiver at the point of entry.

STUDY INSTRUCTIONS

Within the three groups discussed above there is, of course, a wide variety of minor variations to suit individual cars, and the purchaser would be well advised to specify the make and model of the car, and to follow the aerial manufacturer's advice regarding the type to use and the method of mounting. It is obviously impossible to detail, in an article of this kind, all the possible types likely to be encountered.

In general, however, here are some of the points to be observed. Having purchased a suitable aerial, study the maker's instructions carefully. Place the aerial temporarily in the approximate position it is supposed to occupy and check that it is clear of the line of vision and within easy reach.

Decide tentatively where the mounting holes are to be drilled and then check that there is ready access to the other side of the bodywork at these points, remembering that one must be able to asemble nuts, washers, spacers etc. in this space.

A fair amount of caution is justified at this stage since a hole, once drilled, is a distressingly permanent thing if it should happen to be in the wrong place!

When the hole or holes have been drilled the metal inside the panel around at least one of them will need to be

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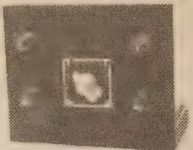

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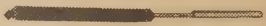

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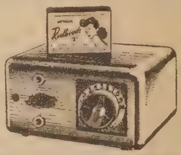

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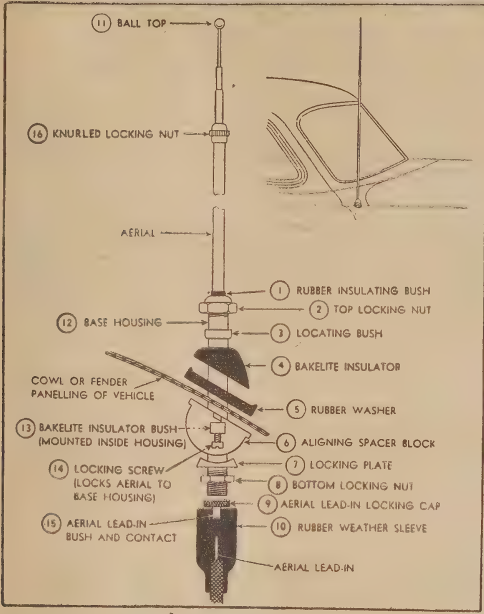
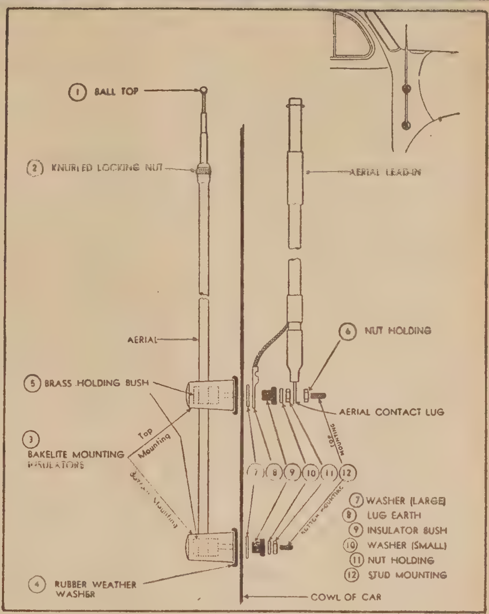
HOW TO FIT STANDARD TYPE AERIALS TO THE CAR



(11) BALL TOP
(16) KNURLED LOCKING NUT
AERIAL
(1) RUBBER INSULATING BUSH
(2) TOP LOCKING NUT
(12) BASE HOUSING
(3) LOCATING BUSH
(4) BAKELITE INSULATOR
COWL OR FENDER PANELLING OF VEHICLE
(5) RUBBER WASHER
(13) BAKELITE INSULATOR BUSH (MOUNTED INSIDE HOUSING)
(6) ALIGNING SPACER BLOCK
(14) LOCKING SCREW (LOCKS AERIAL TO BASE HOUSING)
(7) LOCKING PLATE
(8) BOTTOM LOCKING NUT
(9) AERIAL LEAD-IN LOCKING CAP
(15) AERIAL LEAD-IN BUSH AND CONTACT
(10) RUBBER WEATHER SLEEVE
AERIAL LEAD-IN

Taken from the instruction sheet of a leading car manufacturer, these diagrams give an excellent picture of the construction and mounting of two typical types. The one above is a top cowl or fender mounting type.



(1) BALL TOP
(2) KNURLED LOCKING NUT
AERIAL LEAD-IN
AERIAL
(6) NUT HOLDING
(5) BRASS HOLDING BUSH
AERIAL CONTACT LUG
(3) BAKELITE MOUNTING INSULATORS
Top Mounting
Bottom Mounting
TOP MOUNTING
BOTTOM MOUNTING
(7) (8) (9) (10) (11) (12)
(7) WASHER (LARGE)
(8) LUG EARTH
(9) INSULATOR BUSH
(10) WASHER (SMALL)
(11) NUT HOLDING
(12) STUD MOUNTING
(4) RUBBER WEATHER WASHER
COWL OF CAR

Where the top cowl type cannot be used the side mounting type shown above is very popular. Where the side panelling has more than one "skin," a set of special spacers is available. It is generally necessary to remove some internal trimming to fit this aerial.

thoroughly cleaned to provide an efficient earth bonding point. Professional installation teams use a wire brush, such as are used in decarbonising kits, mounted in a power drill. If a central guide pin can be fitted, so much the better.

Finally, there is the question of suppressing electrical interference. Probably the best approach is to consider first the steps normally taken by professional installation teams — and which should be recorded as the bare minimum —and then to consider what additional steps can be taken to cope with difficult cases.

The professional approach, in addition to those precautions already mentioned, is to bypass the low tension pickup point, bypass the generator lead, and insert a suppressor resistor in the high tension lead to the distributor, placing it as close to the distributor as possible.

HIGH STANDARD

This may sound like an over-simplification of the position, but the fact remains that it works, at least in the great majority of cases. Furthermore, the standard is normally high, calling for complete elimination even under no signal conditions. In this way the performance is limited only by the effective sensitivity of the set.

Of course, it doesn't always work out as easily as that. A particular model car may often turn out to be unduly "noisy" in the electrical sense, and for no apparent reason.

A typical case was that of two English cars, popular a few years ago, by the same maker and differing only in size and horsepower. They used identical electrical systems, including the ignition coils, generator, control systems, etc., yet one was always notoriously noisy and difficult to suppress, while the other responded completely to the standard treatment.

SOME ARE HARD

Again, individual cars of a particular model, normally quite docile, will sometimes turn out to be "cranky", and call for a lot of attention. Generally speaking, the older the car the more chance there is of ignition trouble, apparently due to poor bonding between various parts of the body caused by rust.

The beginner can probably not do better, therefore, than start with this order of suppression. In many cases it may be all that is needed. If not, further steps can be taken.

Bypass capacitors and suppressor resistors are available commercially, and are to be preferred rather than conventional resistors and capacitors.

The capacitors are metal-clad with a mounting lug attached. This forms the earth side of the circuit and an insulated lead forms the other. They are normally mounted under a convenient nut close to the point to be bypassed. They have a capacitance of .5 mfd and are rated at 200 volts.

When bypassing the generator lead make sure that the lead to the field winding is not bypassed by mistake, since this can cause serious damage to the generator in some cases. The two terminals are normally clearly marked, sometimes with a warning not to bypass the field. In any case it is generally easy to recognise the main lead by reason of its being the heavier one.

If there is still some doubt, tracing the leads through to the voltage regulator or other distribution point will usually clarify the position.

By-passing the low tension pick-up point is fairly straightforward, but the actual point used may need to be selected experimentally. Normally it is from the distribution side of the ammeter, thus ensuring that whatever drain the set places on the battery will be shown. However, in stubborn cases of ignition interference it may be necessary to try alternative points. We will have more to say about this later.

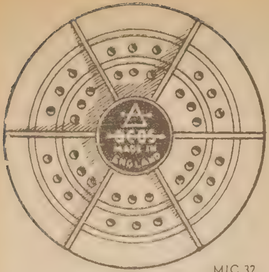
WATCH THE ACTIVE LEAD

Similarly, the earth lead to the power supply may need to be taken to a particular point, though it will usually be satisfactory to earth it to the frame wherever the power supply is mounted.

Incidentally, while working on the electrical system it is advisable to remove the active lead from the battery. A short-circuit can have serious results, particularly as one may be forced to work on sections not protected by a fuse.

Also, if you wear a metal watchband, don't go feeling blindly behind the dashboard. More than one mechanic has ruined a watchband and received a nasty burn by shorting an active terminal to frame.

At this point it may not be out of place to comment on the possible adverse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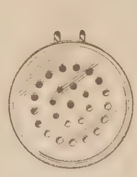
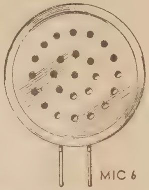
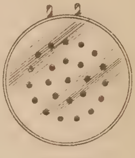
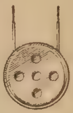

MIC 3


MIC 6


MIC 19

MIC 23


MIC 15

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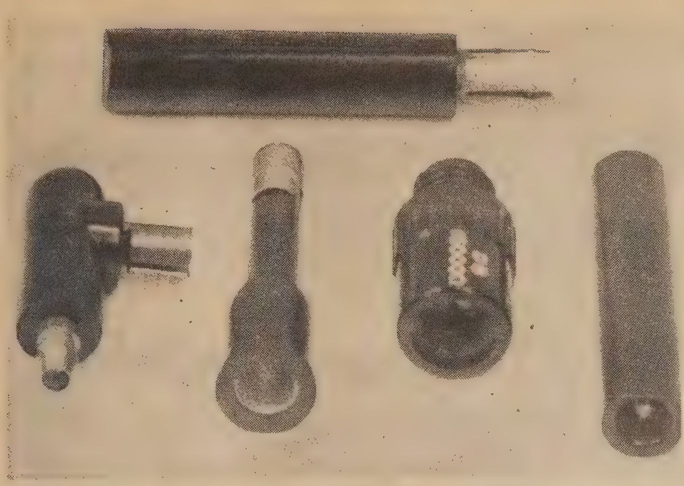

Typical ignition suppressors. The one on the left is for use on individual spark plugs; the remainder are for HT leads. The one on the right is a universal type. The remainder fit specific types of terminals.

effect of ignition suppressor resistors on engine performance.

When car radios were first introduced and it was suggested that such resistors be fitted, most owner-mechanics held up their hands in horror. In spite of assurances from various sources, this prejudice persisted for a long time and there are still those who believe that such tampering with the ignition system is a bad thing.

Fortunately, there has recently been considerable research conducted on this subject and, although a completely clear picture of the exact relationship between the ignition and carburetion systems has not as yet emerged, enough appears to be known to answer most of the questions relating to suppressors.

Briefly, the story appears to be this: If the carburettor is doing a proper job of vaporising the petrol and mixing it with the correct amount of air, then the intensity of the spark is not critical. In these circumstances, almost any kind of spark will ignite the mixture and it will burn completely.

SPARK INTENSITY

However, poor carburetion will produce droplets of pure petrol rather than a mixture of petrol, vapor and air. Under these conditions the mixture will have to rely on the heat generated by the spark to complete the vaporisation process, at least in the immediate vicinity of the spark. When this portion of the mixture fires, it will tend to vaporise the remainder, but there is no guarantee that all the fuel will be usefully burnt.

Naturally, any reduction in spark intensity (whether due to suppressors or any other cause) will be noticed in these circumstances, since the spark is being called upon to do a job which should have been done by the carburettor.

If the ignition system is already "sick", the fitting of suppressors may well prove to be the proverbial "last straw", but this hardly makes a valid case against the use of suppressors.

Summing up, it may be said that suppressors will only adversely affect an engine which is already in need of attention, whether due to faulty ignition, faulty carburetion, or both. An engine in reasonably good tune will suffer negligible effect.

It is perhaps significant that all new cars now being produced in Britain are being fitted with suppressors in an effort to stamp out TV interference. (We may well have similar legislation here soon.) This is with the approval of the motor industry, and which undertook most of the research to prove the points outlined above.

SUPPRESSORS

Suppressor resistors are usually contained in a moulded bakelite housing which provides additional mechanical protection. They are available for either the distributor or individual spark plugs and in a variety of fittings to suit the usual types of terminals. Typical examples are shown in the illustration, along with the by-pass capacitors.

One of the most popular is the "universal" type, having a wood screw thread recessed into each end. It is only necessary to cut the cable and screw the thread into each of the ends thus provided. The resistance of these devices is approximately 15,000 ohms.

A few cars are so designed as to make the fitting of suppressors extremely difficult, to say the least. Typical of these are some of the earlier Ford V8s, which have an ignition coil and distributor made as one unit. Thus there is no "between" where one may fit a conventional suppressor.

Special suppressors for these systems have been made, being fitted as an integral part of the distributor mechanism. However, they are not always easy to obtain and other methods may have to be adopted. About the easiest is to fit separate suppressors to each plug. The only disadvantage appears to be the extra cost.

Having fitted the two by-pass capaci-

(Continued on Page 119)

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A COURSE IN TELEVISION

Continuing on from our last issue, this article adds further to the discussion on ratio detectors, then goes on to explain the use of crystal diodes, the Foster-Seeley circuit and the "gated-beam" discriminator.

PART SIXTEEN

THE circuit arrangement shown last month in figure 98 appears, with minor variations, in some locally-made television receivers. It is identified as an "unbalanced" ratio detector, because of the fact that one of the diode rectifiers is directly earthed.

An alternative "balanced" ratio detector is shown in figure 99. The circuit is sometimes preferred on the grounds that it should permit a more symmetrical curve of output against frequency. Known as the "S" curve, this appeared as figure 95 in the last issue.

The action of the balanced detector is essentially the same as the unbalanced type already explained, the chief point of difference being that the small components are rearranged to establish an intermediate earth point about which the two diode potentials can swing.

BALANCED CIRCUIT

When the incoming signal is unmodulated — therefore at resonance with the input transformer — the input to the two diode elements is the same. Both combine to pass a current through R1 and R2, proportional to the strength of the incoming signal.

Since R1 and R2 are equal and their junction point is earthed, it follows that the potentials across them must also be equal, one being negative and the other positive with respect to earth. The total potential is held by C3 to an average value which is constant for any given strength of input signal.

As in the case of the unbalanced circuit, the negative potential can be used, if desired, for purposes of automatic volume (or gain) control.

Capacitors C1 and C2 are normally quite small in value and merely provide the RF return circuit through the diodes from the tertiary winding.

Should the input frequency shift momentarily from resonance, the input will increase to one diode and decrease to the other, thereby disturbing the balance of the circuit. (Refer figures 96, 97, last month.)

Since the total voltage cannot change, due to the storage effect of C3, the unbalance simply shifts the mean potential of the input transformer secondary and the valve elements connected to it, the tertiary winding and the junction point of C1, C2.

If the input frequency varies at an audio rate, the mean potential of the aforementioned components does likewise, and the resulting audio voltage can be taken off by the network R4, C4.

The discrimination against noise amplitude pulses is the same as described earlier for the circuit in figure 98.

A short-term change in signal amplitude cannot markedly increase the total potential across R1 and R2, because of the storage effect of C3. It does increase momentarily the current through both diodes, but, because both are affected similarly, the ratio of their output does not change, and little or no resultant appears across R4, C4.

In commercial television receivers, the circuit of figure 99 is used quite freely, but with minor amendments to suit the circumstances or the ideas of the designer.

For resistors R1 and R2, 10,000 ohms is a typical value, while C1 and C2 are usually of the order 330 to 470 mfd. Capacitor C3 may be as high as 10 mfd, or as low as 0.5 mfd., depending on the time constant required. A figure of 4 mfd. is typical.

Resistor R4 may typically be 47,000 ohms and C4 about .001 mfd.

Figures 98 and 99 assume the use of a twin thermionic diode, the current type for the purpose being the 6AL5.

Many receiver manufacturers prefer to use a valve in this position, as well as that of video detector, because it may enable them to claim a larger number of valves for the same price than other rival manufacturers.

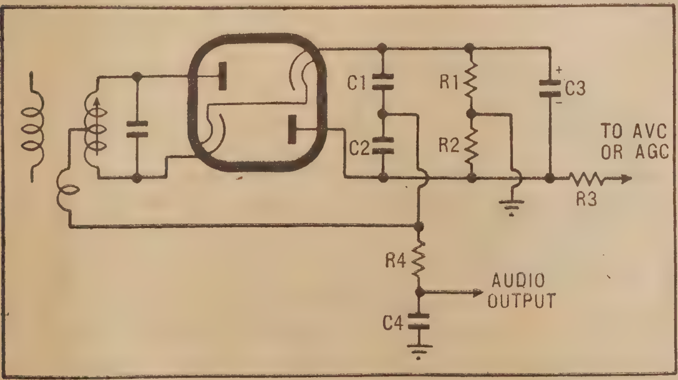

Figure 99: A typical "balanced" ratio detector circuit, which places both diode elements more or less symmetrically above earth potential.

Twin thermionic diodes can also be made with closely balanced electrical characteristics, which ensures optimum performance from the ratio detector circuit, in respect to noise rejection.

MODULATION HUM

On the other hand, it is often claimed that heater-cathode leakage and emission effects can lead to troubles with modulation hum.

The alternative to a twin thermionic diode is a pair of germanium "crystal" diodes. These have the advantage of saving space, saving heater current and eliminating hum troubles. In terms of cost, there is little to choose at present.

The chief problem with germanium diodes is to ensure the balanced electrical characteristics on which a ratio detector largely depends for its noise rejection.

Special diodes have been developed for ratio detector service and the OA72 is typical. However, the manufacturers state that, even though these are selected for favorable high frequency characteristics, provision to balance the circuit should ideally be made.

Figure 100 shows a typical ratio detector circuit in which such provision has been made.

The significant addition is the inclusion of a swamping resistor in series with each diode, the larger resistor being bypassed by a small trimmer capacitor. The value of these components is typical and represents a compromise between good detector efficiency and AM noise rejection.

NOISE REJECTION

In practice, the trimmer should be adjusted for maximum noise rejection in each particular receiver.

It is also noteworthy in passing that the circuit is balanced with respect to earth, as with figure 99, but the configuration has been changed to allow the tertiary coil to be earthed directly and to bring one side of the noise rejection trimmer to near-earth potential.

The audio is taken from a different point in the circuit and different values are used in the audio lead for RF bypassing and treble de-emphasis. Further reference will be made to this later.

Though not directly applicable to present local standards or practice, figure 101 is an interesting performance curve for a "Cyldon" ratio detector transformer. It shows the FM and AM output from a ratio detector, when fed with a signal having an FM deviation of plus and minus 75 Kc and an AM modulation of depth 30 pc.

The effect of using alternative germanium or thermionic diodes is evident in terms of gain, bandwidth and AM rejection. At an IF of 5.5 Mc and with

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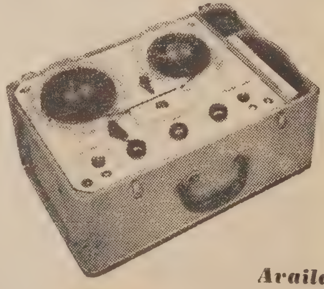

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careful balancing, the differences may, of course, be less apparent.

In a practical IF channel, frequencies beyond about 100 Kc from reference would be attenuated sharply by the preceding transformers so that only that portion of the graph adjacent to the "fo" line is of immediate practical interest.

RATIO TRANSFORMERS

The design of ratio detector transformers is itself a complex and interesting study, which cannot be pursued at this present juncture. Already a variety of patterns has appeared in local commercial receivers ranging from essentially simple miniature units to mechanically complex types in large shield cans.

So much for the ratio detector.

The Foster-Seeley discriminator looks rather like the ratio detector at first glance, in that it uses a similar type of input transformer and a pair of diodes—though differently connected.

The transformer may have either capacitive feed to the centre-tap or a tertiary winding, as per figures 96b and 96c, last month.

When the input signal is at resonance with the transformer, an equal voltage is delivered by each half to the respective diode rectifiers. If the signal deviates from this centre frequency, the voltage relationship changes, one diode receiving more voltage and the other less than originally.

The basic circuit for a Foster-Seeley discriminator is shown in figure 102.

The plates of two diode elements are connected to the outer ends of the transformer, each diode having its own load resistor and bypass.

LOADS IN SERIES

With a resonant input signal, the voltages applied to the two diodes are the same, and, all things being equal, they will develop equal voltages across their respective load circuits R1, C1 and R2, C2.

However, the two loads are effectively in series and the resultant voltage between the outer ends of R1 and R2 will be zero.

For example, if both cathodes are, say, 10 volts positive with respect to the junction of R1, R2 (point X), there will be no potential difference between them.

For purposes of reference, it is conventional to earth one cathode, as shown dotted, so that, with a resonant input signal, the other cathode is also effectively at ground potential.

However, if the signal frequency deviates in a particular direction, the upper diode will receive the greater signal voltage. Therefore, the voltage across R1 will exceed that across R2. The cathode of D1 will be more positive with respect to point "X" than that of D2, so that the resultant will be a positive-going audio pulse.

Taking actual figures, if the voltage across R1 increases momentarily from 10 to 12 and that across R2 decreases simultaneously from 10 to 8, then the potential of point "Y" will become 4 volts positive with respect to earth.

On the alternative modulation cycle, when the signal deviates equally in the other direction, the voltage across R1 will decrease from 10 to 8, while that across R2 will increase from 10 to 12.

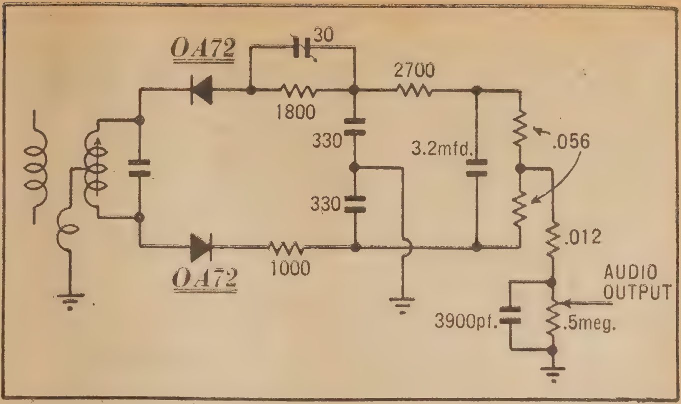

Figure 100: Another balanced ratio detector circuit using somewhat different configuration from figure 99. It also uses germanium diodes. The resistors and capacitor in series with the diodes are to balance their electrical characteristics.

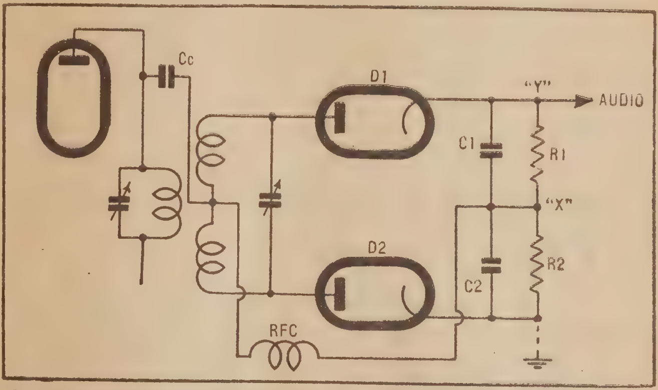

Figure 102: The basic circuit of a Foster-Seeley discriminator. Chief disadvantage is its sensitivity to amplitude variations, necessitating the use of efficient limiting stages.

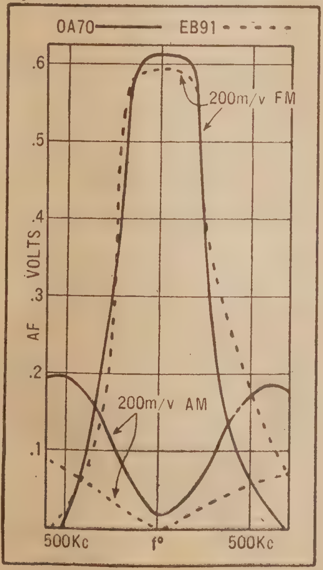

Figure 101: The curve of a ratio detector and associated transformer, showing FM and AM resolution, using alternatively germanium and thermionic diodes.

Thus, point "Y" will become 4 volts negative with respect to earth.

The operation of the detector is, therefore, very simple to follow.

However, unlike the ratio detector, the Foster-Seeley circuit is also responsive to amplitude variations, and the reason for this is not difficult to understand.

If, for any reason, the peak value of the incoming signal is increased, so also will be the voltages developed across R1 and R2. Thus, a 20 per cent increase in signal amplitude will produce, at resonance, say, 12 volts across each resistor, and zero potential at point "Y"

But, off resonance, with the same percentage of deviation as before, the voltages across R1 and R2, respectively, will be 14.4 and 9.6, giving an out-of balance resultant of 4.8 volts instead of 4.0 volts. In other words, a 20 percent increase in peak signal voltage, off resonance gives a 20 per cent increase in audio signal output.

The response of the Foster-Seeley circuit to amplitude variations makes it completely dependant for noise rejection on preceding limiter stages. Since it is

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Transformers to suit above -- -- -- -- -- -- -- **67/6** not convenient or economical to provide extensive limiting in an intercarrier IF channel, the Foster-Seeley circuit is seldom used, in modern television receivers.

During recent years, a type of detector has been developed which is quite different in principle from either the Ratio or the Foster-Seeley circuit. Though it has not displaced these circuits, it has been used in overseas TV and FM receivers and is worthy of special mention.

VARIOUS NAMES

Valves designed for the circuit have been referred to variously as "enneodes" and "nonodes", the more usual term being the "gated beam" FM detector. This latter name at least gives a clue to the operation of the circuit.

It actually involves the use of a valve whose plate current is determined by two separate control grids interposed in the electron stream.

Ideally the grids should have a quite abrupt control, so that they give as nearly as possible a switching action, rather than a gradually tapered rise and fall in plate current.

Thus, with more than a given negative potential on either or both grids, the plate current may be zero. However, a positive-going pulse on either or both grids may cause the plate current to rise very steeply to a saturation level, determined by the operating potentials of the tube and its configuration.

SPECIAL TYPES

Certain frequency changers, notably the 6BE6 can be adapted for use in the circuit, although specialised types such as the EQ80 and 6BE7 are much to be preferred.

Figure 103 shows the construction of the 6BN6 gated-beam detector, which carries the principle to its logical limit.

Electrons emitted from the cathode (left) are confined into a narrow beam by the shield plate which surrounds it. They are then accelerated and focused by a positively-charged accelerator electrode, which is placed just beyond the beam forming shield.

Within the accelerator electrode is the number 1 control grid. When this is at near-zero potential, it allows the electrons to pass through, but, when negatively biased, it simply turns the electrons back, so that they are collected by the accelerator electrode.

Plate current is therefore cut off.

However, should electrons pass through the inner control grid, they are accelerated further by the accelerator plate toward an outer control grid. This latter may either allow the electrons to pass through to the plate or, according to the applied potential, divert them back to the positively-charged accelerator electrode.

Thus, while cathode current remains more or less constant, the actual current to the plate is subject to control by the instantaneous potential on both the inner and the outer grids.

☆

Figure 103: This diagram illustrates the arrangement of electrodes in the 6BN6 "gated beam" FM detector. The whole structure is designed to give the inner and outer control grids an abrupt control over the plate current, so that it tends to flow in pulses.

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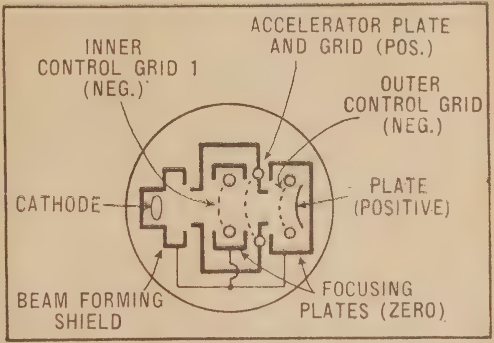
ACCELERATOR PLATE AND GRID (POS.)
INNER CONTROL GRID 1 (NEG.)
OUTER CONTROL GRID (NEG.)
CATHODE
PLATE (POSITIVE)
FOCUSING PLATES (ZERO)
BEAM FORMING SHIELD

For FM detector service, the basic idea is to apply signals to the respective control grids, the signals being displaced in phase by an amount which depends on the input frequency. Thus, as the frequency deviates with modulation, the respective signals on the two grids exhibit a greater or less phase difference. More or less plate current is therefore able to flow and the modulation component appears in the plate output circuit.

There are various ways of achieving this result, but figure 104 illustrates a typical circuit arrangement for the 6BN6.

The input signal is fed to the inner control grid from a normal IF transformer, peaked to the carrier centre frequency. The outer grid is coupled to a quite independent circuit also tuned to this frequency.

Because the incoming signal on the inner grid modulates the electron stream, the tuned circuit connected to the outer grid is maintained in a state of sympathetic oscillation. Phase relationships in the circuit are such that the signal voltage on the outer grid is 90 degrees displaced in phase from the inner grid.

Plate current flows in bursts (or pulses) during the brief intervals when both grids are in the vicinity of their positive-going signal peaks.

Should the signal deviate above its reference frequency, the phase difference between the two signals increases and there is a shorter time interval in each input cycle during which both grids are sufficiently above cut-off to permit plate current to flow.

The average plate current therefore diminishes.

For a frequency deviation below reference, the reverse is true. As the phase difference between the grid signals diminishes they pass through each positive-going half-cycle more nearly in synchronism and the average plate current rises.

Thus the average plate current, which depends on the length of the plate current pulses during each input cycle, reproduces the original modulation component — the audio signal, in other words.

The reason for the term "gated beam" is obvious enough from this description. The electron stream is in the nature of a beam and the action of the grids is sufficiently abrupt to support the idea of the beam being "gated" so that it flows in a series of pulses.

The length of these pulses, one to each RF input cycle, determines what the average plate current will be, as observed over an audio cycle.

SATURATION SIGNAL

For correct operating conditions, the input signal to the inner grid should be of sufficient order to ensure that each plate current pulse reaches the current saturation point.

This being so, no increase in signal amplitude can produce a further increase in plate current, so that the detector is not responsive to AM components. Like the ratio detector, it therefore does not depend on limiters for its noise rejection characteristics.

Main criticism of the tube in practice has been that it is not always possible to drive the valve to saturation on weak signals, so that the noise rejection characteristics suffer. However, the later, gated-beam, tubes, such as the 6BN6, are better in this respect than the earlier types.

(Continued next month)

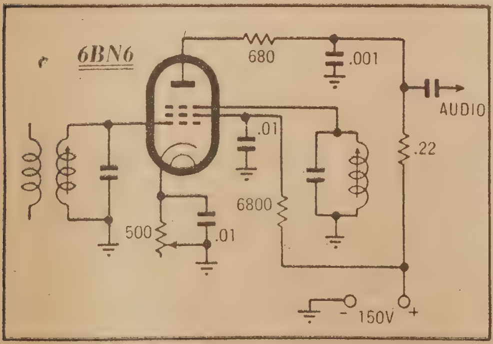

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Figure 104: A typical circuit arrangement for the 6BN6 gated beam FM detector. Noise rejection depends on the ability of the incoming signal to drive the plate current to saturation during each current pulse.

☆

Here's your answer, Tom!

Once again most of this month's questions are submitted by a newcomer to radio, who in his own words, "is a new radio-ite, having had the bug for only 18 months". We feel sure that these may be of interest to our younger readers who are faced with similar problems.

TOM'S first query seems to indicate that he is a budding audiophile, to use a word coined by an overseas magazine.

* * *

Just recently I bought a GP20 pickup and on the equaliser circuit was the following, "to grid, which should be O/C." What does this O/C mean?

The abbreviation O/C, Tom, stands for open circuit. In the case of your equaliser circuit, it refers to the grid of the valve to which the equaliser is connected.

It means that the grid return circuit should be open, or that there should not be a grid leak, since a resistor in the equaliser network becomes the grid leak when the equaliser is in circuit.

You see, Tom, if a grid leak was already in circuit and the equaliser were connected across it, the total value of the load on the pickup or equaliser circuit would become less than the value of the smaller one and perhaps too low to permit correct operation.

In television set circuits you often see chokes in the filament circuits. Why are these necessary, since the filament is isolated from the cathode? Why are centre-tapped filament windings used?

Chokes are used in the filament circuits of television receivers, Tom, not so much because they are television receivers but because they are HF receivers.

At the high frequencies involved it is very easy for feedback to take place between circuits through the heater wiring, even if it is apparently at earth potential.

Even if it does not cause active oscillation, regenerative effects can distort the shape of the IF selectivity curve and prejudice the appearance of the picture.

Centre-tapped heater circuits are not by any means universal in TV receivers. They may be used on occasions as a possible safeguard against hum, arising particularly in the detector circuits.

* * *

How do you calculate the values of tappings on a voltage divider?

Voltage divider values are calculated by means of Ohm's Law, Tom, although the approach varies according to whether one assumes a value of bleed current or a value of resistance for sections of the divider network.

Broadly speaking the lower the resistance of the voltage divided, the better the regulation of the whole device, but the greater the bleed current and the load on the rectifier valve.

Let's take the first approach, by way of illustration.

A suitable figure of current is selected. This becomes the bleeder or the waste current and flows in the voltage divider whether or not there are any loads connected across the various taps.

Selecting a value of say 25 mA as the bleeder current, let us assume that three voltage taps are required, giving 50 volts at 5mA, 105 volts at 20 mA and 190 volts at 30 mA respectively.

BLEED CURRENT

Referring to figure 1, we see that only the bleed current flows through R1, and it is a simple matter to calculate the value of resistance necessary to give a voltage drop of 50 volts, which will appear between points A and B. According to Ohm's Law, the value of R1 is E divided by I or 50 divided by .025 amps, which gives us 2000 ohms.

Going further with the calculations we see that R2 has the bleeder current of 25mA plus the 5 mA, drawn from the 50 volt tap, flowing through it. The voltage drop across R2 is 105 volts less the drop across R1. The value of R2 is then 55 volts divided by .03 amp, which gives us 1834 ohms.

Taking R3 next, we see that the bleeder current, plus the current drawn at the 50 volt tap, plus the current at the 105 volt tap, flow through it. The voltage drop across R3 is 190 volts less the sum of the voltage drops across R1 and R2, that is 85 volts. The value of R3 then is 85 volts divided by .05mA, which gives us a value of 1700 ohms.

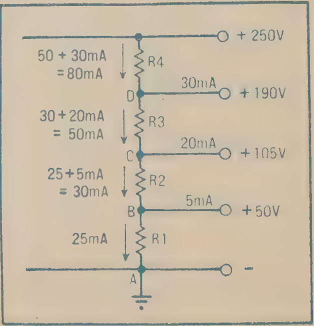


Fig. 1—Current, voltage and resistance relationship, in the design of a voltage divider, discussed in the text.

The final value of R4 is seen to have the sum of all the currents in the divider flowing through it. Assuming the high tension to be 250 volts, a drop of 60 volts is required to give 190 volts at point D. The value of R4 then is 60 volts divided by .08 amp, which gives us 750 ohms.

The total value of the divider then is 6284 ohms with taps at 750 ohms, 1700 ohms, 1834 ohms and 2000 ohms.

If the divider is a single winding of resistance wire, it must have a current carrying capacity equal to the maximum current which flows in any section. In terms of wattage the heat dissipated is equal to volts times amps. Referring to figure one the wattage will be 250 times .08 amp which gives us 20 watts.

Using individual resistors, the wattage rating of each may be calculated by the following formula; watts are equal to volts multiplied by amps. Do not forget to convert milliamps to amps, or if you do not wish to work with decimals, then use the value of milliamps but divide the total by 1000.

Voltage dividers are often made as a whole winding with sliding taps. This is advantageous as it allows a very fine degree of control over the voltages available at the various taps.

* * *

What happens when a valve is microphonic?

A valve is microphonic, Tom, when its elements are subject to vibration sufficient to cause variations in the plate current. These variations are amplified and reproduced as a howling sound from the loudspeaker.

Microphony is most noticeable in low-level stages, and varies from valve to valve. In severe cases the howling sound from the loudspeaker may add to the vibration of the electrodes, resulting in an acoustic feedback loop.

* * *

In a recent trade review you referred to an amplifier without an output transformer. How does this work, and is it possible to feed a cathode follower directly into a loudspeaker?

An output-transformerless amplifier, Tom, makes use of power amplifier valves with a very low output inpedance and often connected as cathode-followers. A number of valves may have to be connected in parallel to obtain the necessary power output and an ability to operate into the very low load resistance presented by a loudspeaker voice coil.

Where push-pull operation is used, a centre-tapped voice coil is necessary. Usually only speakers with a high voice coil impedance are suitable for use with such amplifiers.

A great difficulty and disadvantage with amplifiers of this type is the design of a suitable power supply. Due to the heavy current drain of the output stage, the power supply has to be unduly large and complex to maintain good regulation and ensure low hum content.

In actual fact, the order of distortion introduced by modern high quality output transformers is very low, and it is generally considered not worthwhile to dispense with this item, when designing an amplifier, at the extra expense and complexity of a transformerless one.

★ ★ ★

What is a radio-range beacon?

A radio range beacon, Tom, is a navigational aid for aircraft. It consists of a beacon for guiding aircraft on a specified course. The beacon radiates two beams on the same carrier frequency, both modulated by morse, one according to the letter A (. —) and the other by the letter N (— .).

The course to be followed is covered by an overlap region, in which both signals are heard simultaneously and merge to form a continuous note.

By listening to the modulating signals, the pilot can determine whether he is on the correct course, or if he is to the left or to the right of it and can take action accordingly.

★ ★ ★

I have frequently seen reference made to various rays. Now how many are there and what are they?

The subject of rays, Tom, could take up several pages but we shall endeavor to explain them in the limited space available.

Rays are paths traversed by wave forms, the velocity of propagation of which is the speed of light, and whose wavelengths vary between about .0001 Angstrom units (an Angstrom unit equals .00000001 cm) and .04 cm. All light and electromagnetic energy is transmitted by such waveforms.

There are many kinds of rays and research into these is being continuously extended. We shall mention some of the better-known types.

At the extreme of the range we have cosmic rays, whose wavelengths vary from about 3 times 10 to the power of minus 8 metres to about 3 times 10 to the power of minus 11. They are detectable by means of an electroscope and have great penetrating power.

Their origin is not definitely established but it is thought that they originate in interstellar space.

GAMMA RAYS

Gamma rays which have wavelengths of 1.4 to .01 Angstrom units, are emitted by radio-active substances during spontaneous disintegration.

Alpha and beta rays, which are also emitted by radio-active substances, are more penetrating than gamma rays.

Cathode rays, which give rise to x-rays, are produced by streams of electrons emitted from a cathode in the presence of a rarefied gas.

X-rays have a wavelength of 120 to .06 Angstrom units, and are produced when cathode rays strike matter. X-rays are widely used in medicine. Since they have the capacity of penetrating matter that is opaque to white light, it is possible to photograph the internal regions of the body.

Ultra-violet rays are invisible to the human eye, as their wavelength is below 4000 Angstrom units which is the limit of visibility at the violet end of the visible light spectrum. Within limits these rays are beneficial to health and are emitted by hot bodies and ionized gases.

Visible light occupies a narrow band between the ultra-violet and the infrared.

Infra-red rays are lower in frequency and have wavelengths of from .04 cm to .00007 cm. These are really heat-rays produced by metals which are heated to a temperature below that at which they emit a red glow.

The lower end of the infra-red band overlaps the radio-frequency band, the highest frequencies of which are being employed for radar and television work, the medium to high frequencies for communications and normal radio entertainment work.

The lower frequencies are in the audible range, as one encounters in gramophone reproduction, etc.

★ ★ ★

What is refraction and is it applicable to radio?

Refraction, Tom, is applicable to radio waves as well as to light waves, and means a deflection or bending of these waves when they enter a medium of different density from that in which they have been travelling.

Radio rays are refracted when they pass through ionised layers. The ratio of the velocity of the waves in free ether to that in a refractive medium is known as the refractive index of that medium.

The refractive index of water, for example, is greater than unity, but the refractive index of an ionised layer is less than unity.

★ ★ ★

Why are not all pin connections used on valves in RT and H circuits?

In the old days, Tom, valves were made with pins to correspond with the number of electrodes in the valve. This necessitated the use of a variety of valve sockets and a move was made to adopt a standard socket which had enough pins to accommodate all likely valves.

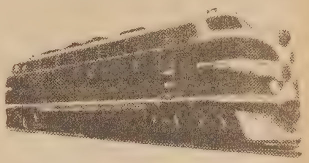
With the consequent introduction of the octal base, valves with less than eight electrodes had a number of spare pins. These not used were marked "NC" or "no connection". In certain cases, however, spare pins in a valve base have been used as anchor points for the internal electrodes, the pin then being marked "internal connection".

Modern 7-pin miniature and 9-pin inoval valves are in exactly the same category with regards to unused pins. Some pins are left unused, while others have internal connections. Under no circumstances must the "internal connection" pins be used as anchor points for other circuits.

However, Tom, the main point is that you needn't worry about pin numbers which aren't provided for on our circuits. There's no omission on our part. If you want to, you can always check the point by reference to valve data charts.

FERRIS Electric TRAINS

Accurately Engineered just like the real ones



NEW DIESEL ELECTRIC LOCO

Another true-to-the-real-thing achievement by Ferris. The F53 is modelled on the famous diesel electric locomotive that pulls the "Spirit of Progress" and "The Overland". It features the usual sweet running motor and sturdy construction.

Price £8/9/9

F51/5 LOCOMOTIVE

This engine looks and is a powerful unit. It will fit into any "0" gauge layout. Powered by the new Ferris electric motor with automatic stop, start and reverse and rubber tyres fitted to the main driving wheels. An engineered job at only **£12/3/0**

Carriages, trucks, luggage vans, rails, points etc. are available for use with the locomotives illustrated.

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Please send me an illustrated brochure and price list of all Ferris Train equipment available.

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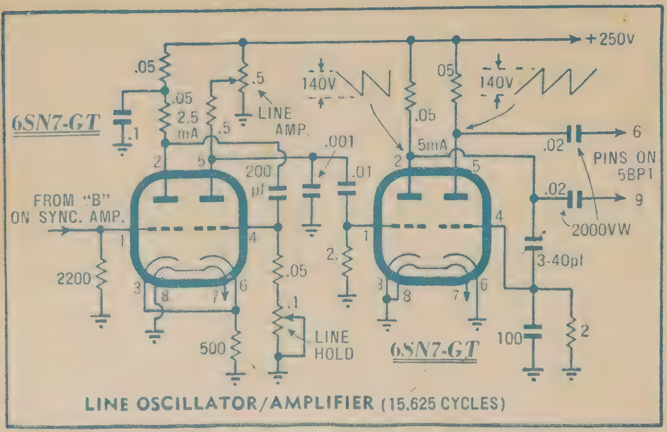


The line oscillator provides the voltages which sweep the picture line from left to right, being kept "in step" by the pulse from the synchronising pulse amplifier. Check waveforms are shown at output points.

USING A 5-INCH TUBE FOR TV

The coming of TV has spurred technical interest to an amazing degree, not only professionally but among the ever present hordes of radio-minded people who like to experiment and make their own. We have never been under any illusions that, sooner or later, we would have to face the problems of home-built receivers.

HOW many people are really interested in "rolling their own?" Would the job be too hard for more than a handful of enthusiasts? Would they be able to get their sets going once they had been built? How would they line them up when they were ready to go?

Until recently, the answer to most of these questions was very much in the air. There just hasn't been enough time yet for us to do more than make a start on some standard receiver construction on a routine basis with a view to producing worthwhile copy at a later date.

WIDE INTEREST

Are people interested in building TV sets? There appears to be no doubt of this. Already probably a dozen people to our knowledge have made standard 17-inch sets, and produced pictures, with no more to guide them than their own radio background and a circuit of a standard set. Some of them used the Philips circuit we published a few months ago to illustrate an article on receiver design.

Many of these sets used home-built components and coils, others were made with the assistance of factory units, wholly or partly, which somehow the enthusiast seems to be able to rustle up from undisclosed sources!

Admittedly these people were somewhat beyond the "Little General" stage, but the fact is they did make their sets work.

Now we become aware of the second wave of keen types, who have stocks of disposals valves in the junk box: old radar sets full of coils and sockets, and of course, one of those 5BP1 valves which were not long ago sold in thousands for less than 10/-, and which are still available at quite low cost.

Judging from our correspondence, these are much more numerous than the first type with more elaborate ideas and their success has likewise been somewhat variable. But here again, each day brings news through the grapevine of someone's friend who has managed to get a picture after much fiddling about, or yet another who has hitched up his 5in CRO to a maze of circuitry and seen something on the screen.

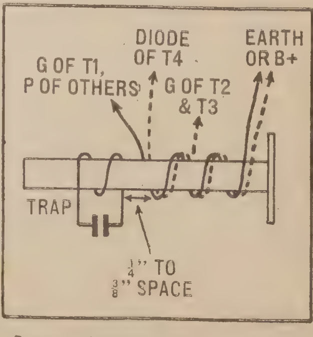


Diagram showing constructional details of T1, T2, T3 and T4. Winding details given in the coil table.

In the mailbag we have had many queries asking about the more difficult points of circuitry from those obviously determined to "give it a go".

Their main attraction to the project seems to be that there is so little money involved, and even if they become hopelessly boxed they would have had their money's worth in fun and experience.

Gradually we became convinced that if we could present some reliable information which these stalwarts could get their teeth into, there would be quite enough readers interested in the idea to make our efforts very much worth while.

At odd times, therefore, we began to beat our brains against a wall, arguing about the band widths we could get away with on a small screen, the merits of various power supplies and tuners, and how much the whole thing was likely to cost. We accumulated a box of 6AC7's under the table, brushed the dust off a few 5BP1's and then went back to the task of preparing the next issue.

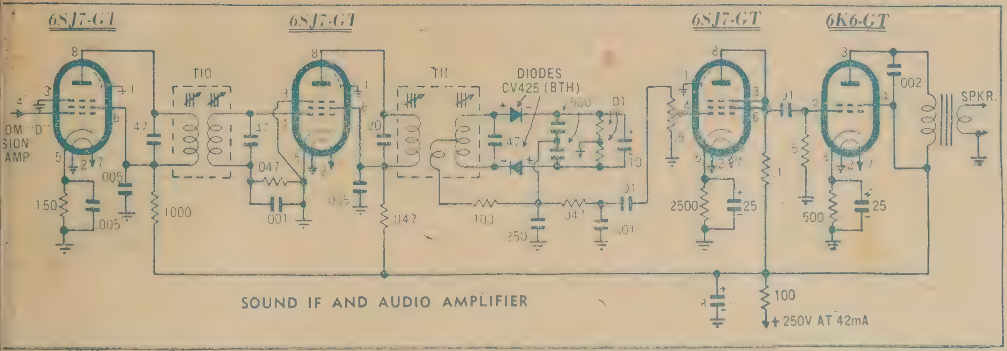
At this stage, our old friend Mr. Gil Miles, who some years ago wrote a splendid series of articles for us on radio control for models, and who spends his life making up all kinds of unusual apparatus with enormous energy and success, rang on the phone to ask whether we would be interested to see a TV set he had built out of disposals parts, and which was giving him good signals?

An evening or two later we stood before a typical home-experimental chassis with a front end tuning box bolted to the side, a row of valves on the chassis, and a 5BP1 which, believe it or not, gave forth a beautiful little picture of what was happening on a local TV station.

REALLY WORKED

An hour spent fiddling with controls and poring over the "innards" made it quite plain that here at least was one example of a home-built though humble receiver which really worked.

True, a few corners had been cut in circuitry, and others carried out in a perhaps too-faithful commercial tradition, but it was obvious that Gil had solved many of the problems which must be bothering quite a few of our readers



SOUND IF AND AUDIO AMPLIFIER

'he sound IF channel is fed with 5.5 MC input from the vision channel (from point C) and is a standard FM circuit with an easily adjusted ratio detector. Variations are of course quite allowable in the audio amplifier.

ho are treading the same path. More-
'er he was quite happy to place his
periences at our disposal, uttering the
ous hope that not too many readers
ould put pen to paper and barrage him
th further questions.

With the exception of the front-end
ner, all the coils had been home-
ound on formers available from radio
ops, and wherever possible, disposals
mponents had been pressed to service.

This, then, is the background of the
ticle we present here, and explains just
ny we have given it to you in this form.

So far, two almost identical models of
s particular receiver have been built up,
e other having as its basis an ASV
sposals type of chassis and front-end
lt the general circuitry is the same, as
e the results.

Mr. Miles makes the point, and we
ree with him, that in its present form
s set is not ideal for a full description
our normal constructional basis. It
his "prototype", and as so often hap-
ns, he has just learned enough about
yout, etc., to start on a second and
ore orderly model.

JNER & POWER

For instance, it isn't much use plung-
; into a full constructional article until
have worked ou a suitable front-end
ner for the set, as there is little purpose
starting out on such a project with the
ords, "Take one commercial turret-
ned front-end", which will probably
you back £20. if you can get it.

His power supply, too, uses a trans-
rmer and rectifier, likely to be a risky
ocedure unless you are extremely care-
l, as most such supplies can provide
much of a wallop for safety. We
rtainly don't want to have any damag-
readers on our conscience.

But, on the other hand, the video and
und channels, for instance, have all
en worked out in a perfectly practical
hion — they are good enough to serve
a full-sized set at a later date if the
ilder should progress as far as that.

It is our intention to proceed immedi-
ly to build up a full receiver on this
neral pattern, so that in a few months'
ne, if all goes well, we can pursue
project to its logical conclusion, and
e specific instructions from start to
ish.

In the meantime, those who are able
solve some of these problems for
mselves need not be held up for the
swers.

Concerning front-ends, we could suggest that the idea of using an ASV tuner for single channel operation is a perfectly good idea. These tuners, with a pair of 954 RF amplifiers, and 955 mixer and oscillator, slug-tuned, and covering about 170-210 Mc, should work just as well for a TV station as they did for radar, although you will have to modify the oscillator coil slightly to place it on the high side of the station frequency rather than the lower, where it probably is at present. It might even be possible to cover both channels 7 and 9 with some ingenuity.

Some years ago we remodelled one of these into a 250 Mc receiver for some special work, and it went quite well — not comparable in many ways with a modern unit, but more than adequate for strong local signals.

As far as the CRO power supply is concerned, we have already worked out an RF power unit which will be described in our January issue as an individual article, and in it we will include some suggestions of using it with a receiver built on the general lines of the one detailed here.

Not later than the February issue, we should be able to give some constructional details on a front-end of simplified design for use with home-built TV tuners, which should help those who are in trouble in this direction.

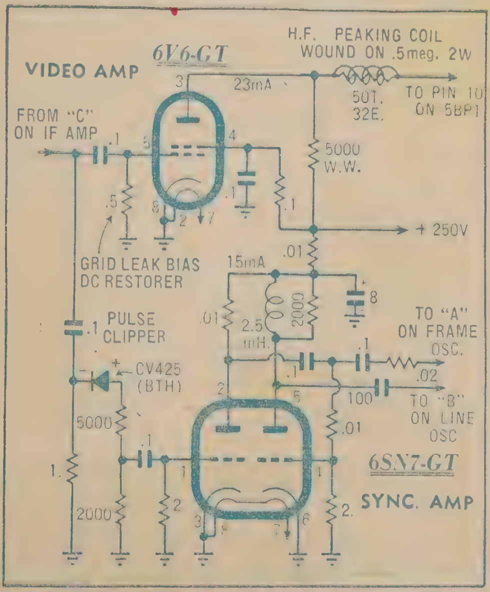
PRACTICAL VERSION

Finally, in two or three months' time (yes, we take some holidays, too!), we should be able to bring them all together, with possibly some modifications worked out in the meantime, and cover the subject from start to finish.

And not long after that, we'll probably have something to say about making a full-sized 17-inch job.

Even if you don't particularly want to see your pictures in green, or have any real use for such a set, don't underestimate what you will learn and at very low

This unit contains the video amplifier (top) which provides adequate voltage for the 625 line deflection circuit, and (bottom) a pulse clipper circuit from which a voltage is obtained to operate the amplifier for synchronising pulses which trigger the frame oscillator.

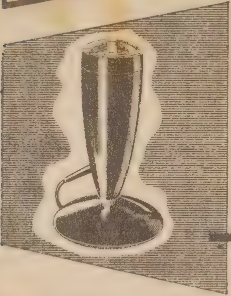


acos

A COMPLETE RANGE

CRYSTAL MICROPHONES
MICROPHONE INSERTS

FOR EVERY PURPOSE



DESK or HAND MICROPHONE, MIC36

This Microphone is ideal for home recording and public address, etc. Response unexcelled for its size and price. The performance is not affected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. Recommended load resistance not less than 1 megohm, dependent on low frequency response. Can be supplied complete with switch and floor stand adaptor, as required, at a small extra cost. **PRICE, £6/18/6.**

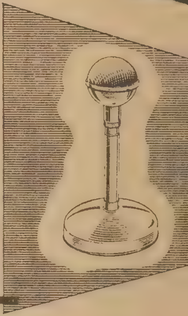
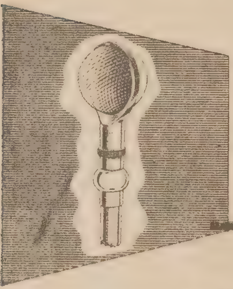


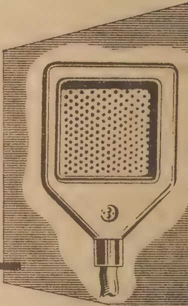
TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE, £9/18/6.**



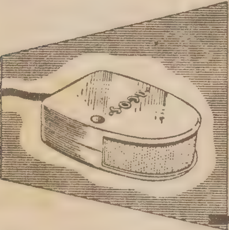
HIGH-QUALITY MICROPHONE, MIC16

This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise. **PRICE, £24/19/6.**



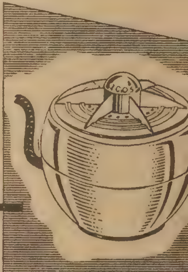
LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6.**



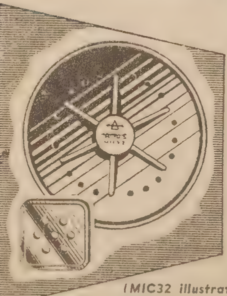
GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substanially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**



HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**



(MIC32 illustrated)
(MIC23 illustrated)

CRYSTAL MICROPHONE INSERTS

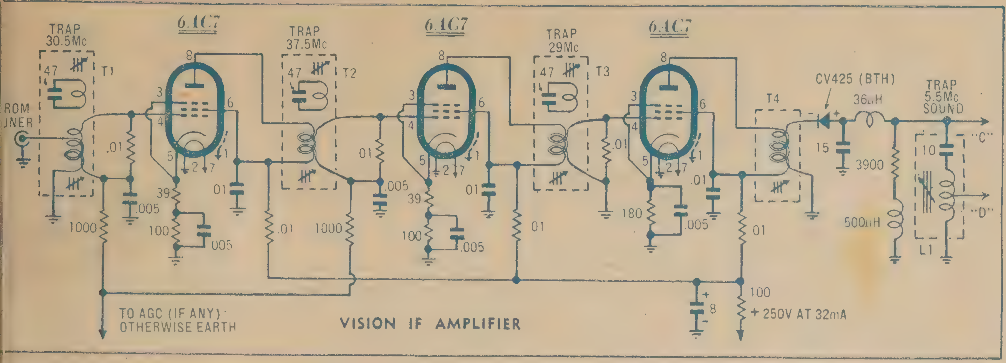
These inserts are available in varying sizes, ranging from as small as $\frac{13}{16}$ in. square to 1-$\frac{13}{16}$ in. round, with various thicknesses from $\frac{7}{32}$ in. to $\frac{9}{16}$ in. Suitable for every purpose, such as hearing aids, public address, tape recording, amateur transmitters, etc., they have responses from 2,250 c.p.s. to 3,500 c.p.s. at -5 db to -30 db. Insert can be supplied with or without 10 meg. resistor as required.

MIC19/4 and MIC32, **£2/15/6**; all others, **£1/19/6.**

Sole Australian Agents:

AMPLION (A'sia) **PTY. LTD.** 88 Parramatta Road Camperdown
Sydney, N.S.W. Phone LA 6124

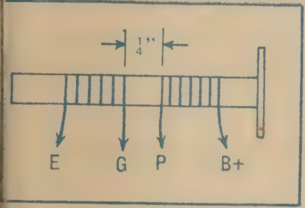
Victorian Distributors: DISTRIBUTORS CORPORATION, 403 Bourke Street, Melbourne.



The video IF strip is the heart of the entire receiver. A full description of it is included in the test.

ist, by making one. Students, service- n and technicians could scarcely find better method of getting practical ex- rience in the new art.

However, that's enough of prelimin- . Let us now have a look at the cuits shown here, and read some of



How T10 is wound.

notes prepared from information sup- ed by Mr. Miles and an anonymous end of equal enthusiasm, who was re- onsible for the coil design.

SION AMPLIFIER

This is the section of the receiver st likely to cause worry to the con- uctor, and our notes are therefore more elaborate than those dealing with the remainder of the circuit.

Three valves together with four tuned circuits are used in the amplifier unit to form a staggered quadruple group, the tuner being coupled through a low impedance link to the first transformer T1. This is standard practice.

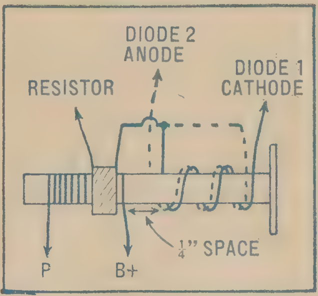
The second, third and fourth transformers use bifilar windings to achieve close coupling, wide bandwidth, and a low DC resistance between the respective grids and earth, a method also currently used in commercial receivers.

The secondaries of T1, T2 and T3 are loaded with 10K resistors again to improve the bandwidth. This value may be frowned upon by many designers, but it has proved a good compromise between band-width and reasonable gain. The last transformer, T4, is obviously loaded by the impedance of the diode circuit.

Since the intercarrier system is used in this receiver, it was necessary to use a trap circuit tuned to 30.6 Mc to attenuate the sound carrier some 20 db below the mid-band response.

Additional traps were also included at 29 Mc and 37.5 Mc, not so much to attenuate any possible adjacent channel transmission as to help to give the correct response curve in the receiver itself.

Automatic Gain Control (AGC) was not included in this receiver as it was considered to be more in the nature of a refinement to be added at a later stage. However, a suitable lead has been provided so that it may be applied to the first and second tubes if required.



T11 is the coil for the ratio detector. This is how it is wound.

COIL DATA

All coils are wound on 7mm formers, 2¼" long and tuned by means of OBA iron dust cores.

T1

Sec., 15 turns 30 B & S single silk enam., close wound.
Pri., 2 turns 30 B & S SSE over earthy end of Sec.

Trap
8 turns 20 B & S Enam.
Tuning capacitance 47PF
Frequency 30.5 Mc/s

T2

Pri., 15 turns 30 B & S SSE
Sec., 10 turns 30 B & S SSE
Bifilar wound

Trap
6 turns 20 B & S enam.
Capacitance 47PF
Frequency, 37.5 Mc/s

T3

Pri., 17 turns 30 B & S SSE
Sec. 11 turns 30 B & S SSE
Bifilar wound

Trap
9 turns 20 B & S Enam.
Capacitance 47PF
Frequency 29 Mc/s

T4

Pri., 17 turns 30 B & S SSE
Sec., 17 turns 30 B & S SSE
Bifilar wound

No trap.

T10

Pri., 50 turns 37 B & S Enam. close wound
Sec., 50 turns 37 B & S Enam. close wound

Each winding tuned with 47PF capacitor.

T11

Pri., 60 turns 33 B & S SSE close wound.
Tuning capacitor 20 PF
Sec., 25 + 25 turns 30 B & S SSE, bifilar wound.
Tuning capacitor 47PF
Tertiary. 15 turns 33 B & S SSE close wound over primary.

L1

100 turns 37 B & S Enam., close wound with centre tap.
Tuning capacitor 10PF.

Note. All capacitors are placed inside shield can.

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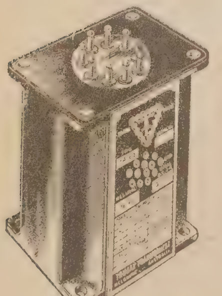

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Christmas Greetings

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n strong signal areas AGC might be ound essential unless a small aerial is sed to control the amplitude of the input signal.

The unbypassed resistor of 39 ohms included in the cathode circuits of hese two valves to compensate for ariation of input capacitance which ikes place when the bias is varied by n AGC connection.

This point was covered recently in n instalment of our "Course in Telesion".

ALVES

The valves themselves are 6AC7's hich are plentiful and cheap to buy om disposals sources. In performnce, the EF50 is probably just as ood. If a supply of 6CB6 or 6BX6's available, these may work a little etter.

In the output section of the unit, most any general purpose germanium iode is suitable. If you are buying ne there are some types which the akers recommend as being particularly pplicable.

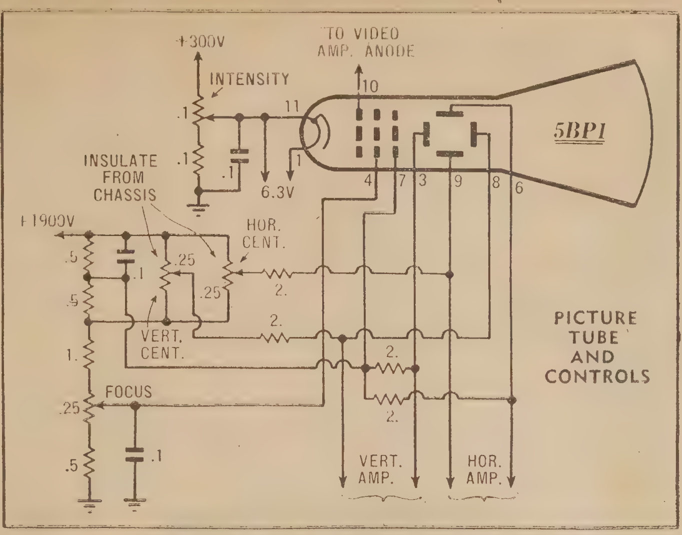
This diode is quite small, and is best laced inside the transformer shield can.

The 5.5 Mc sound trap performs e dual purpose of providing a series ned trap to attenuate the 5.5 Mc interarrier beat, and as a take-off point for e sound IF amplifier (from point D). he video signal passes through series nd shunt peaking circuits to preserve e high frequency response before being pplied to the video amplifier (from oint C).

IDEO ALIGNMENT

Undoubtedly the best method of igning the amplifier is by means of sweep oscillator with a swep of about 0 Mc, and a CRO.

If the oscillator has a built-in marker enerator, this is a great advantage. If sweep oscillator is not available, a gnal generator and a sensitive DC oltmeter my be used plus a good deal f patience on the part of the construcor.



The picture tube circuit is substantially the same as that used for an ordinary CRO, and there is nothing here to puzzle you. An RF power supply of about 2000 volts is advised.

Connect the oscillator to the coupling link on T1 and the CRO to the diode output, using shielded cables. The oscillator output should be kept as low as practicable to prevent overloading the amplifier, and the gain of the CRO turned well up.

As soon as some kind of response curve is obtained, adjust all the traps to their respective frequencies, keeping the coupling between the trap and the tuned circuit fairly low at this stage.

Next, return to the tuned circuits and continue tuning until something in the nature of the desired pass band is obtained. It will probably be necessary to increase the coupling of the traps before a satisfactory curve is obtained

Avoid sharp peaks in the overall curve, which may be caused by too many circuits being tuned to the same frequency. Remember that the object is to get sufficient bandwidth, and not maximum gain.

If all goes well, a curve something like that shown in these pages should be obtained.

SOUND STRIP

This amplifier is quite a simple arrangement using two valves. The first operates as a conventional amplifier with cathode bias, while the second operates as a limiter feeding the ratio detector.

A twin diode valve can be used in place of the germanium diode, but the latter will work equally well. As balance is important in the operation of all FM detector circuits, balanced diodes are to be preferred. (This point is also covered in the current instalment of the Course in Television.)

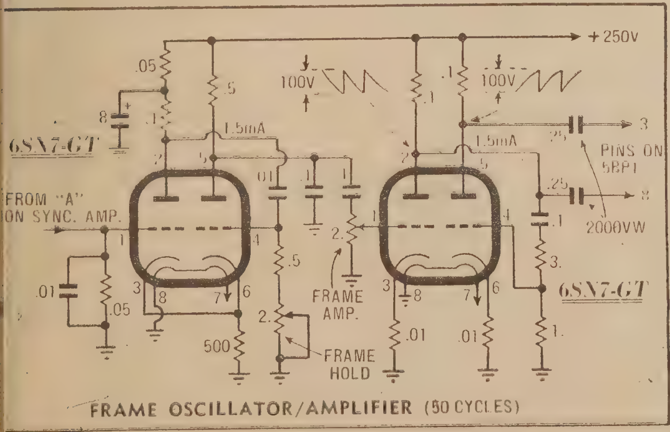
The output to the audio amplifier is taken from the junction of the 47K resistor and the .001 mfd capacitor, forming the de-emphasis network, and in turn is fed from the tertiary winding on T11.

Connect a signal generator set to 5.5 Mc (unmodulated) to the grid of the first valve (point D) and a sensitive voltmeter between either the plate or cathode on the load side of the twin diode and earth.

Tune both primary and secondary of T10, and the primary of T11, for maximum reading on the meter.

Transfer the meter to the junction of the 47K resistor and the .001 mfd capacitor and tune the secondary of T11 for zero reading.

Note there are three points for such a reading—(1) when the secondary is tuned well away from resonance on the low frequency side, (2) at resonance, the desired condition, and (3) well away from resonance on the high frequency side.



The frame oscillator provides a voltage to sweep the tube from top to bottom 50 times each second, so that the 625 lines from the line oscillator are distributed across the tube face.

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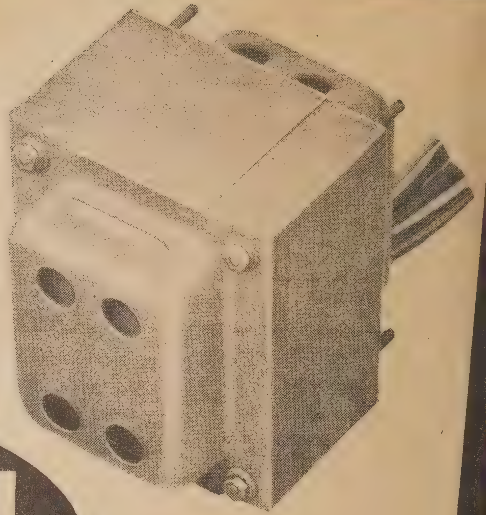

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TRANSFORMER TV275/260
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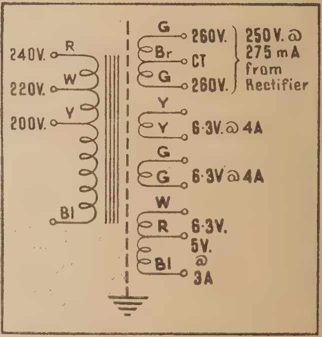

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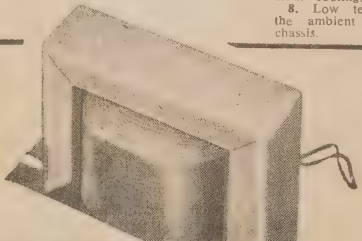

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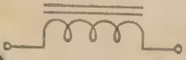

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The resonance point is quite sharp.

If the sweep oscillator used for the on IF amplifier is capable of being to 5.5 Mc with a sweep of say 500 the familar "S" curve of the ratio tector may be displayed on the CRO. diagram of such a curve is included.

When a signal is received from the nsmitter, it is desirable to repeat the gnment of the sound IF amplifier if ere is any doubt as to the accuracy of signal generator's 5.5 Mc reading. a rule the voltage developed by the nal from the transmitter is quite sufient to produce a considerable voltage the ratio detector, so that both align ent and balance can be checked by ing it as the input source.

If the ratio transformer itself is not gned and balanced, the signal will und distorted, and tuning the receiver ll not make any improvement in this gard. In practice, the alignment of sound strip is not particularly diffilt.

NE & FRAME CIRCUITS

In these units both oscillators oper- in a similar fashion, but are indendent of each other, each using a dified cathode-coupled multi-vibrator angement which generates saw-tooth ve-forms.

The "free-running" frequency of the cillators is controlled in each case varying the resistance in the grid cuit, these adjustments being designted "Frame hold" and "Line hold" the vertical and horizontal oscillas respectively.

Special circuitry is required to achieve rfectly linear wave-forms, and complition here has been purposely avoided.

The linearity of the wave-forms shown the circuits, is approximately good ough, and to quote one authority e definition of good linearity is purely arbitrary one since it depends on visual accuracy of the observer just the definition of 'good audio quality' pends upon the listener".

To obtain push-pull deflection, a al valve phase inverter is used. The st valve amplifies the oscillator outt, producing the required peak-to-peak v-tooth voltage. The second valve verts the output.

The adjustments for equal output carried out in the case of the line plifier by the 3-40 pf variable capaci- connected between the amplifier ode and grid, and for the frame plifier by variation in the value of the meg. resistor. Once having found the rrect value for these, they can be and left alone.

Because harmonics of the original v-tooth wave-form (up to about the th) are involved, different types of ight and width controls are necesy. In the case of the frame amplifier, simple potentiometer in the grid cirit is sufficient, because the frequency in the audio range.

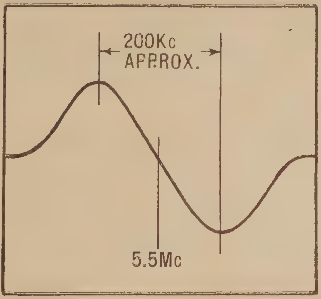
As a specially compensated volume ntrol in this position would otherse be required, in the case of the e amplifier it is easier to vary the supply to the oscillator.

LSE CLIPPER

The pulse clipper removes the pic- signal, leaving only the synchronis- pulses, which are then amplified and plied to the vertical and horizontal oscillators through the respective integrating and differentiating networks. There is sufficient gain and output voltages from these amplifiers to provide the necessary deflection for a 5in tube.

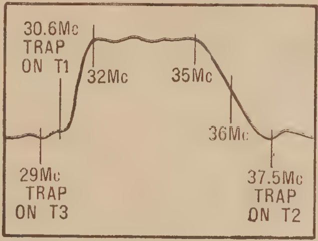
THE VIDEO AMPLIFIER

The composite signal from the video detector at the end of the video 'F strip is capacitively coupled to the video amplifier. Because of the coupling capacitor, the DC picture level has been lost, and must be restored.



Typical "S" curve of the ratio detector output showing correct circuit balance.

This is accomplished at the grid of the 6V6 video amplifier by the grid leak bias action, so that the video amplifier grid acts as a DC restorer as well as an amplifier control grid.



Approximate shape of the waveform passed by the video IF strip when properly aligned.

The amplifier is operated without cathode or fixed bias, but grid leak bias developed during the synchronising pulses serves to clamp all signals so that the sync. pulse tips lie on the zero line.

A few words may be helpful at this stage about chassis layout, although without prejudice to anything we may do in our own prototype receiver.

In the normal way the tuner will need to be near one front corner of the chassis, with the IF strip close behind. Normally these two are connected by a coaxial lead, which should not be more than about 6in overall.

It is often helpful to mount the IF strip across the chassis, underneath the picture tube and as far forward as it can conveniently go. This leaves the rear of the chassis free for the circuits which must connect to the picture tube socket.

Thus, the video amplifier would be located close to the video detector in the IF strip. This could then feed the picture tube and also the synch. separation circuits.

From here, the signal would pass to the two sawtooth oscillators and thence to the deflector plates.

As far as is possible, the components to do with each of these circuit groups should be bunched together and not intermingled with components from another circuit. Interference can occur from time-base into audio circuits, or between time-bases to produce quite fantastic non-linear effects.

If at all possible, the receiver should be powered by a low radiation transformer, located toward one rear corner of the chassis. Hum deflection of the spot is a hazard in a TV receiver, just as in a CRO.

TUBE SHIELD

Mu-metal or water-pipe shields around the neck of the picture tube can alleviate bad hum deflection but cannot always cure it.

The IF strip itself should be laid out with a view to minimising feedback. A logical scheme is to have the video IF pass straight down one side of a rectangular sub-chassis, from IF input to video detector.

The intercarrier section can double back along the other side of the subchassis, with a full-length shield partition in between. This can commence with the sound take-off from the video detector, passing through the 5.5 Mc amplifier, the ratio detector and thence into the audio stages on the same subchassis, if desired.

By way of conclusion, a few general remarks may be helpful on the subject of disposals type tubes. Quite a variety of these have appeared on the market, ranging from 3in up to 12in types, both magnetically and electrostatically deflected.

The 3in types can be forgotten, because the picture available on their screen can hardly be taken seriously.

Likewise the magnetically deflected types are of no immediate use with the present circuitry, because they require deflection coils and the provision of deflection currents of the appropriate waveform, as distinct from deflection voltages.

It is not an insuperable problem but quite a different one.

THE 5BPI

The 5BP1, already assumed in the foregoing circuitry, has been available in large numbers and has the advantage of being fairly easy to mount. A water socket only is required, which has also been available.

Another advantage of the 5BP1 is in the fact that it has an almost flat screen. Maximum use can therefore be made of the screen surface and, by allowing the picture to be rounded a little more than usual at the corners, a considerable width of picture can be obtained.

The obvious alternative to the 5BP1 is the VCR97, a 6in tube of English design. This is credited with being, in some ways, a better tube than the 5BP1, but it is more cumbersome and requires a special and rather bulky socket.

Readers who may have to use this tube should refer to the July and August, 1056,(issues, under the "Reader Built It" page for details of socket connections and construction.

The screen of the VCR97 is quite rounded in shape and the difference in

(Continued on Page 115)

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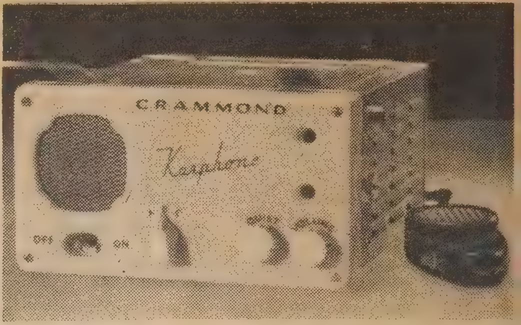

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FROM THE SERVICEMAN WHO TELLS

I appear to be "flogging" the theme of electrical safety and public ignorance I can only ead "Truth and (I hope) public benefit". Anyway, I simply couldn't allow this month's choice ory to pass without comment—even if it does bring the wrath of the Housewives' Association down on my head.

ALL start by asking my reader a estion: What is the most dangerous e in the world?

ou're a physicist you will probably one of the fissionable materials with, say, cobalt 60.

ou're just an ordinary citizen, per- more than a little worried by the the road, you will probably sug- etrol and alcohol.

if you're a serviceman you'll say nen and electricity!

member of the R TV and H staff reviewed these lines suggested that ectricity wasn't strictly necessary to mbination. But then, he's a con- cynic.)

D TO BEAT

ously though, I thought my recent about the lass who imagined low appliances were not dangerous, e one who sat the teapot on top unprotected electric jug, would lot of beating. I was wrong. I t the story I am about to tell beats both.

tarted when a bright young society n tripped gaily into the shop and ted a soft leather zippered bag e counter. "I do hope you can wireless," she gushed, unzippering g as she spoke. "It's a lovely set. such a beautiful tone you know. can't find anyone to fix it, and hink these older sets have a much tone than the new ones, don't

hout waiting for my reply (which, s, was just as well) she went on lain that everyone she had taken so far had opined that it wasn't fixing and had quoted various ts as its trade-in value on a new

oked at the set sitting in the middle open bag and I wasn't really sur- It was a nondescript creation, cer- unlike any make I had seen be- he cabinet being of some yellowish- mottled plastic of uncertain age yling.

GH HANDLING

ending from the dial cutout to the was a gaping crack. Another om the speaker fret to the opposite corner and part of the dial glass nissing. It didn't need Sherlock s to deduce that it had been drop-

attention was also drawn to some- which seemed to be flopping d inside the cabinet, as I turned er for examination. On closer tion this turned out to be the r which, as far as I could see, ot fastened to anything. It was sitting in the cut-out on the s.

valves and other major com- ts were a motley collection, sug- g a home-made unit, and not very well made at that. Altogether it was a most unprepossessing set-up, the equivalent of which, in the motor car industry, is known as a "bomb". For the life of me I couldn't imagine how its owner could justify her praise of its "beautiful tone".

But all this is more or less in a day's work, and one encounters similar sets and similar owners, in varying degrees, almost every week. What really rocked me was the nature of the repair the lady required.

The broken dial glass? The smashed cabinet? The wobbly speaker? No, it was none of these things. Apparently they were of no consequence. What was really worrying her was the plug on the end of the power cable. She thought it had been damaged and wasn't quite sure whether she should use it or have a new one fitted. The same apparently applied to a two-way adaptor which she fished from the inner recesses of the bag.

The plug was a "bayonet adaptor"—the type of thing that fits a light socket—and the double adaptor was a similar fitting. The "business end" of the plug was badly charred, as was also one receptacle of the double adaptor. Sensing an "incident", I probed gently as to the cause of the damage.

ASKING FOR TROUBLE

And out came the whole amazing story. It seemed that either the plug or the socket—or both—had been a trifle undersize or out of tolerance in some respect, such that the combination did not provide reliable contact.

Accordingly some obliging male friend had effected a temporary cure by inserting two small pieces of metal between the contacts of the plug and socket in such a manner as to compensate for the poor fit. The exact method he used to fit them or the form they took will probably never be known, for the lady was delightfully vague in her explanation. All I could learn was that a couple of pieces of metal had been used to fix the plug.

Although probably justified as an emergency repair, it is hardly the type of thing one would recommend for permanent use. Nevertheless, like many "temporary" repairs, it apparently became accepted as a permanent part of the set-up.

SERIAL COMING UP

Inevitably, of course, the lady removed the plug for some reason—and promptly lost the two metal scraps. So there she was, alone in the house, a serial coming up, and no radio. The situation was desperate, and clearly called for some feminine intuition, or whatever it is the fair sex call on in times of emergency.

Now what could she substitute? It had to be metal, she knew that much, but where could she find pieces of metal which would fit in such a space?

Then came the brainwave. In the kitchen was a bundle of steel wool, normally destined for the humble task of cleaning grimy saucepans. It was metal, why shouldn't it do?

So our heroine grasped a handful of steel wool, stuffed it in the socket of the double adaptor, forced the plug in on top of it, and plugged the whole fearsome assembly into the light socket. Then she turned on the light switch. The result, in her own words, was "a display of blue lights that scared the wits out of me!" Then she added, "I'm never going to touch anything electrical again. I'm too scared."

VAPORISED FUSE

Well, dear lady, with an imagination like yours, I'd say that was the safest course you could adopt.

Naturally, the fuses were vaporised by such harsh treatment, but I hate to think what might have happened had some "wise guy" fitted one of those super-heavy duty fuses I have come across at times. Something would have to go, and I can imagine cables glowing a nice dull red somewhere up in the ceiling.

As it was there was no great harm done, but it does rather rock one to realise the kind of approach which some people have to such things and the kind of strife they can get themselves into.

I must admit that I have heard of similar cases before, though this is the first one I have encountered. The only difference was that a sixpenny-piece was used in place of the steel wool. I imagine it would be just as effective, if not quite as spectacular.

USE FOR A SIXPENCE

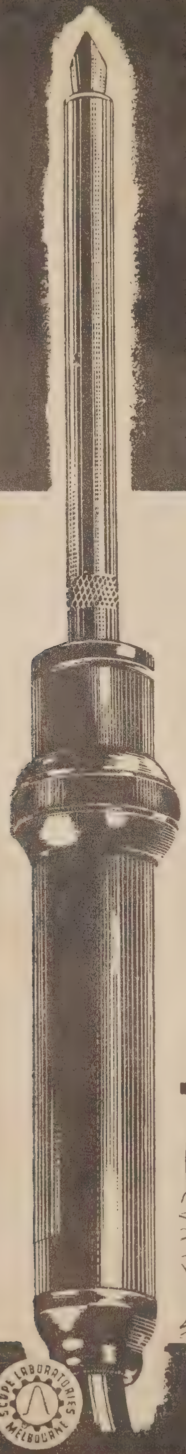
The R TV and H boy to whom I referred at the beginning of this story also recalled a similar use for a sixpence, though for a completely different purpose. It seems that, as a youth, he lived up in the hills and travelled a long distance to and from high school each day by train.

The homeward journey, at least during the winter months, was mostly after sunset and it was then that his fellow students practised their art of fitting a sixpence behind a light bulb so that the fuse would blow when it was switched on.

Why? Well, apparently, the soft glow of the twilight provided a more favorable atmosphere for those extra-curricular social activities normally associated with co-education.

Yes, to be sure, love will find a way.

From an essentially practical point of view I can only comment that (assuming one must do this kind of thing) the use of a sixpence is to be preferred to the steel wool. The former simply blows



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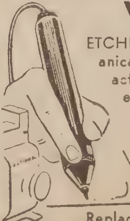

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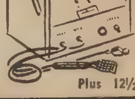

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'uses — and that's that. The latter s in the same manner as a fuse, ng an area of charred bakelite.

; a matter of interest, I removed plug from the cable and connected ohm meter across the terminals. It 500 ohms and I suspect that it d drop to a much lower value with gher voltage applied. There was no urable resistance across the double-tor pins, but the charred condition not inspire me to take a chance. placed it, also.

; for the rest of the set — well, there 't a great deal I could do without rring a lot of expense. Closer examon revealed that the cabinet had rently been dropped more than once. first cracks had been ingeniously red by means of metal plates ed to the inside. The later ones been ignored. Short of a new cabiwhich would be difficult and expen-there was nothing I could do.

ATING SPEAKER

imagined that at least I would be to anchor the speaker more securely, when I slipped the chassis out I sed why it had not been done origin- The nature of the chassis cut-out such as to make it very difficult to or it to the chassis. On the other l, there did not seem to be much ibility of fixing it to the cabinet, y by reason of the cut-out size, and y due to the cracks.

ather than risk further damage, or lve the owner in more expense than justified, I decided to leave well e. I gave a routine electrical check, blished that it was working as well ould be expected and put the mess together again.

; I expected, the owner was perfectly y to learn that I had simply replaced ittings and checked the set over.

om ancient mantel sets we go to systems and, in particular, to that ying characteristic known as "feed-". There is probably nothing more ying, after having set up a lot of oment, than to discover that one ot achieve a reasonable volume be-e of acoustic feedback.

cidentally, this problem is one about h there seems to be a surprising unt of misconception. If one likes elve into the matter deeply enough will find an almost unlimited numof theories concerning the cause and of this effect — and most of them, greater or lesser degree, are fallacies.

DBACK

ne reason, I suppose, is that audio ifiers (and, hence, PA systems) repnt one of the simpler branches of ronics. The chap who fiddles with does not necessarily need to have n background and, in his ignorance, easily be misled to make incorrect ctions from observed effects.

ne of the most popular fallacies is a particular amplifier gives trouble use it is too "powerful". (The exact ning of the word "powerful" in this e is rather obscure. It can mean er output, sensitivity, or a rather lous something which appears to be ombination of both.)

rangely enough, there is an exact osite to this theory, suggesting that amplifier is not powerful enough. reasoning can be further subdivided ollows: (1) that the amplifier is not erful enough because the volume able (as limited by the feedback) is not sufficient for the job, or (2) that a more powerful amplifier would not require the volume control to be advanced as far, thus (supposedly) reducing the feedback.

A variation on this theme puts the blame on the microphone. One school of thought reasons that a low sensitivity microphone is best, since it will then be less sensitive to the sound coming from the speaker. The opposite school has a complex theory, namely, that the most sensitive microphone possible should be used, the reasoning being that a less sensitive amplifier will then be needed and (presumably) that the feedback will be reduced in direct proportion to the reduction in sensitivity.

I'm afraid that trying to argue against ideas like that is like trying to argue with a woman — even if you're right you seldom win!

A rather more scientific fallacy suggests that one cannot possibly expect to control an amplifier unless it has available a considerable amount of top cut. It is quite surprising how many fellows —otherwise fairly well clued up—firmly believe that this is an essential requirement for the control of feedback.

CAUSES

Just what is the true situation, and what are the logical steps to take in order to minimise feedback? Even more important—if we don't wish to be side-tracked in our thinking — what causes feedback?

Feedback will occur in any PA system when the volume of sound from the speaker, when it returns to the microphone, is equal to or greater than the original sound. That may sound like an over-simplification of the case, but, in fact, it completely covers the situation.

Suppose we take a mythical case as an example. Let us assume that a sound, having a level which we will call one unit, is fed into a microphone. Let us further assume that the gain of the system is such that the resultant sound from the speaker, when it eventually finds its way back to the microphone, is equal to only .5 of a unit. In other words, there is a loss from the microphone, through the system and back to the microphone, of two to one.

Now, this speaker output, which has been "heard" by the microphone, will be fed into the amplifier and again appear in the speaker. However, having come from a weaker source, it will be weaker by the same amount. Thus, when it reaches the microphone again it will be equal to only .25 of a unit.

Fairly obviously the level is dropping rapidly and will soon be reduced to a negligible value. As a result, no persistent feedback occurs.

MULTIPLE GAIN

Now, suppose we increase the gain of the system so that one unit of sound fed into the microphone results in two units being returned to it from the speaker. In other words a gain, on the round trip, of two to one. These two units will now return four units, the four units eight units, and so on, the level building up rapidly and obviously being quite capable of sustaining itself. Result: Feedback in the form.

THE ENTIRE SYSTEM

In fact, of course, the overall gain need not be as high as two to one; I simply chose such a figure to make it easier. (Easier for me, I mean!) Theoretically, a gain of one would be sufficient, but anything greater than this certainly would.

Now, what can we deduce from the above? Simply this: Feedback depends on the gain of the ENTIRE system (including the acoustics) from the microphone, through the full circuit, and back to the microphone again. All that matters is whether the sound returned to the microphone is greater than the original or not.

"Oh—am I late?"

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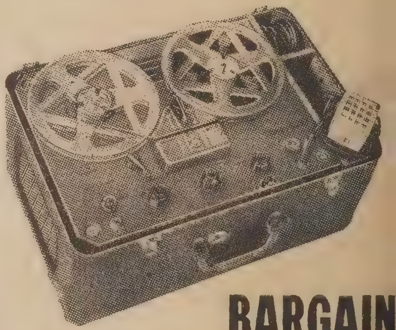

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matters not how this gain is dis-
ted in various parts of the system.
ther we use a carbon microphone
sh the thought!) with a low gain
ifier or a ribbon microphone with
gh gain amplifier; an amplifier with
times as much power (or sensitivity)
serve as we shall ever need or one
is barely adequate; a lot of power
low efficiency speakers or the best
kers we can get with proportionately
power; in all cases it is the OVER-
gain that matters, not that of a
cular part.

this point I know that several
rs are just itching to tell me that
n't know what I'm talking about;
such "theories" may be all very
but they don't work in practice;
that they can show me practical
that some microphones are more
tive to feedback than others. They
also demonstrate that adding some
cut to an amplifier can materially
e the feedback. So, how do I
in that?

LF TRUTHS

is so often the case, these ideas
'half truths" which have originated
such observations. They are "half
s" in the sense that it is possible, for
ple, to demonstrate that one micro-
e is more prone to feedback, all
being equal, than another type
n, among other things, may be less
ive.

at much is true, certainly, but the
y lies in the reasoning which seeks
late the observed results to the sen-
y. The real cause can be summed
one word: "peaks".

we test two microphones, identical
nsitivity but having differing re-
e curves, we will observe some
interesting results. Assume, for
of argument, that one microphone
n essentially level response with no
, and that the other has a single
unced peak amounting to, say,
at 3500 cps.

ere is little doubt that this latter
phone will come off second best in
est of "proneness to feedback", and
e thought on the matter will quickly
l why.

far as feedback is concerned the
n using the peaky microphone will
db more sensitive than that using
vel microphone. In other words, the
of the amplifier would have to be
less in order to avoid feedback,
wise AT 3500 CPS, the signal re-
d to the microphone from the
er would be greater than the
al sound.

CT OF PEAKS

t, and this is the important point,
ducing the gain of the amplifier to
nmodate this peak we have reduced
level from the speakers, at fre-
cies OTHER THAN 3500 CPS, by
And, since a great deal more use-
ignal energy is contained in that
of the spectrum outside this peak
particularly on the lower side of
an in the relatively narrow peak
we will have effectively lowered
utput from the speakers (as far as
udience is concerned) by 6 db.

rthermore, the sharper the peak the
pronounced this effect will be,
the very sharpest peak is still cap-
of causing feedback, yet contributes
lly nothing to the useful sound
ed from the speakers.

llowing this reasoning to its logical
conclusion it is easy to see the origin of the idea of restricting the top response of the amplifier. Such restriction will obviously tend to offset the peak in the system, even though it must encroach on the useful part of the spectrum.

Unfortunately, by the time the peak has been completely suppressed, the result is a serious top cut in the useful portion and a compromise setting is generally necessary. A better approach would be a trap circuit adjusted to match exactly the width and amplitude of the peak, but a practical version of such a device is not always as easy to produce in practice as it is on paper.

RESPONSE AND OUTPUT

Far better to start with a microphone reasonably free from peaks, which will permit the system to operate at maximum efficiency without the need for special compensation.

And a thought to round off the discussion is that good quality, "flat" microphones frequently have a lower output than cheaper types, some of the sensitivity microphones give less feedback smoothing the response. Could this be the reason for the idea that low sensitivity microphones gives less feedback than high sensitivity types?

What I started out to write was a more practical example of the theories I have just expounded, which first directed my thoughts along these lines.

It concerned a typical installation in a suburban bowling club and was brought to my notice by a business acquaintance and member of the club. Since he had dabbled in radio for many years, could read a circuit, carry out running repairs, and knew a lot of technical terms, he had been unanimously elected as "OC P.A. system".

While being mildly flattered by the honor bestowed upon him, he was also keenly aware that the system, as it stood, was far from satisfactory. In the circumstances he felt that he had to make some worthwhile contribution to the problem if he was to justify his official standing — and maintain his reputation. Thus it was that he sought my advice.

He explained that the trouble was feedback and then gave me a brief description of the installation. The clubhouse was about 50 feet long, with speaker located at one end and the microphone at the other. As it was, there was considerable difficulty in obtaining enough level from the speaker to serve any useful purpose before the onset of feedback.

"I know the set-up is not ideal," he went on, "but we will probably have to put up with it for the present. At any rate until we have some major alterations made to the clubhouse. Just the same, I'd like to try what I could to improve things in the meantime."

MORE FEEDBACK

I agreed that the idea of locating the speaker and microphone as he had described was not the best since, as far as I could tell, the sound was being directed back towards the microphone. Even allowing for the distance between them there would still be more coupling than was desirable.

The exact reason for the arrangement was rather obscure, the system having been like that for many years. Apparently it was partly due to a desire to put as much distance between the speaker

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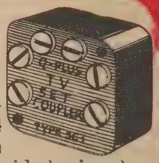

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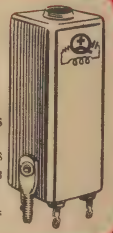

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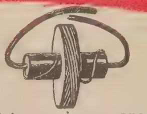

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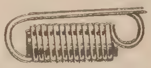

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the microphone as possible, and y by the need to direct most sound that part of the room.

nyway, it seemed to me that a much r arrangement would be to use a le of short flare type horns, located r to the microphone, but facing from it and directed into the nce area.

OTHER RESPONSE

y friend agreed, but wanted to know ere was anything else, particularly in lectrical sense, which could be done nprove matters. I have a sneaking cion that he was the victim of some e fallacies I have already listed.

asked him what type of microphone as using and he replied that it was stal type and named the make and number. I was immediately sus- us, having had experience with that cular type before. Although a good rmer in many ways, it is not noted ts smooth response and is therefore suitable for PA work.

suggested another type, also a crys- ut one which I knew, also from ex- nce, was a good deal smoother than xisting type. In fact, I had already had the opportunity to substitute the one for the other in a PA installation, and the improvement had been most marked.

When I explained all this, along with a thumbnail sketch as to why it was so, my friend announced his intention of taking my advice. I expressed the hope (to myself) that none of my choice theories would be exploded by some factor which may have been overlooked by both of us.

I need not have worried. When next I saw my friend he was jubilant. "I tried the new mike the other night," was his opening remark. "It really did the trick. We can now turn the system up to a useful level without any sign of feedback. I must say the improvement rather rocked me though. I hardly thought it possible."

He went on to say that he intended to take the rest of my advice as soon as possible, and modify the speaker system. In the meantime the new microphone had at least made the installation workable.

And so two reputations were enhanced; mine with my friend, and my friend's with his fellow club members. So everyone was happy.

IESE MEN MADE TELEVISION HISTORY

(Continued from Page 7)

notice of David Sarnoff, president he Radio Corporation of America. off immediately grasped the im- ance of the ideas that sparked rykin and he decided to back him all of the resources RCA had to .

onsequently, the two men were king at the same time along similar , though strangely neither had heard he other. Both were rushing new nts to the patents office as fast hey were formulated. It was in- ble that the most important de- pment should clash.

hen they learned of the situation, side appealed to Washington for cision, for by this time it was clear a multi-million dollar industry was he making. Whoever was granted basic patents would possibly har- a fortune.

ENTS CLASH

he patents office requested both to present their cases at a hear- The records of it run to many mes, but the facts could be boiled n to a single issue: Which man d prove conclusively that he had the first to conceive and create image dissector?

arnsworth had no dated sketches, ledger entries, in fact nothing to e that he had drawn up the formula his apparatus as a 16-year-old olboy in 1922.

Can you produce the sketch?" ask- a lawyer.

t was made in chalk on a black- rd one afternoon after school." e the reply.

Did anyone see it?"

Yes. My teacher, Justin Tolman."

olman was eventually found and ght to the hearing. It was proved he satisfaction of all parties that had had no contact with young Farnsworth since the lad left the district in the spring of 1923. Yet from memory the schoolmaster drew a diagram of the apparatus that had been shown to him in chalk. He also said that such an impression had been made on his mind at the time that he was able to repeat every detail of the system described by his pupil.

The decision went to Farnsworth.

Today both Farnsworth and Zworykin are actively and prosperously engaged in TV research and they share a great number of US patents. Farnsworth is now 50 and the head of a company which specialises in electronic research.

Zworykin later devised his orthicon-iconoscope and kinescope, the basis of present-day transmitters and receivers, and today is possibly the most active man in television research in the world.

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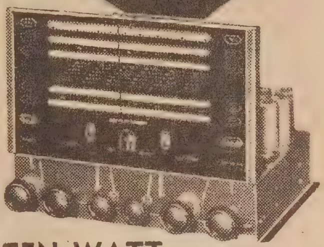

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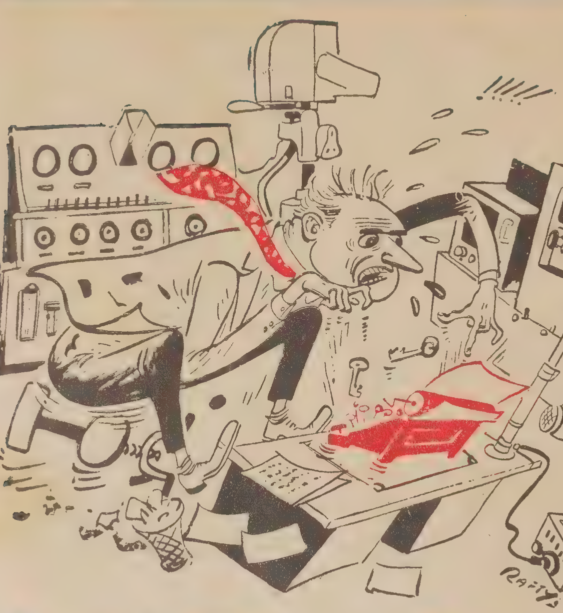


Let's Buy An Argumen

Many a different note has been struck in these columns since their introduction in Septemb
1950 but never before has the theme of love been pursued. Love and romance in a techni
magazine? Why not? It seems to permeate everything else in life.

by *Neville Williams*

LET me tell you the story, simply and unadorned.

It really happened some weeks back, while I was watching one of the early television broadcasts. I forget the details now but I seem to remember a film of some kind, one or two "commercials" and a lot of talk about the future of TV.

Then SHE appeared!

To describe her accurately is beyond me, but she stood there — shapely, smiling, charming and a trifle self-conscious beneath the glare of the lights.

She was looking straight at me!

JUST WE TWO

The crowd around seemed to melt into the distance and we were alone — SHE and I — with only a sheet of glass between us. The very electrons seemed to glow with life, as they painted her image on the screen.

Never before had cathode-rays been used to such good purpose. She was beautiful.

Then somewhere in the background an orchestra came to life and SHE was singing.

Yes, she could sing as well!

I didn't know the song but I can remember her every gesture — the little smile, the tilt of the nose, the way she held her hands.

Ah, ma cherie!

Then a sudden movement in the crowd reminded me where I was. Other people were looking at her too, over my shoulder. In fact, all around the shop, gazing intently at the television screen, were tight little groups.

The man behind me was tight anyway!

Were they all watching and listening to . . . my dream girl? I had to know.

Quickly I slipped from in front of the set and over to the next group, standing on tip-toe and peering over a carpet of shoulders to follow their gaze.

But who was this? They certainly weren't watching MY dream-girl.
sure, this one was dressed like h
was singing the same song — eve
the same kind of gestures!

But this girl was a dumpy,
over-fed imitation of the real thi

Even her make-up was wron
lining her eyes and her lips
horrible highlight.

But how? Why? Some other
perhaps, trying to steal the au
What a forlorn hope.

IF ONLY!

If only these poor misguided
knew about the original. Poor peo

Then who were the third group
ing? My girl or the horrible tubb
ation?

I slipped quietly along to the th
but horror of horrors . . . the
watching neither.

This was another girl entirely,
the same, singing the same kind o
but skinny and undernourished
make-up wasn't bad, but there was
thing wrong with her hairdo. The
have been, because she kept it
most of the time above the top
picture.

What's more, she had a horribl
of contorting her features as she

One moment she'd tilt her he
pull a face like a horse. Then she'
over the other way and pucker
like a feminine Popeye.

It was a horrible exhibition. I c
get back to my dream-girl
enough.

A little later, I walked home t
the night, at the one time elated
and sad.

Elated because I had seen
smiling at me!

Sad because she had disappeare
ing the screen colder and greye
ever it had been before.

Angry, because station manag
had stooped to such tactics. Tr
ridicule my dream-girl by un
imitation.

But now I am bewildered,
the shopkeeper has told me that
sets were tuned to the same pr
that it was the same girl!

That it was all due to "natu
ferences between television sets
just a matter of adjustment".

"A matter of adjustment," h
when a man's heart is at breakin

Just think of it. You can
a couple of knobs at the back of
vision set and alter the proport
an artiste at will.

And that's what's breaking my

n't be sure just what my dream-girl
y looks like. Is she tubby, or skinny
tably in-between?

e knobs on the set don't say and the
s at the station won't tell!

oe is me.

t seriously, behind this bit of non-
is a good deal of truth as will be
nt to anyone who has walked from
set in some of the television show-
s, now blossoming in this fair city.
fferences in performance and picture
acter fairly hit one in the eye and
ise a fertile field for future argu-
s.

at's fine.

IOUS HUES

It would certainly seem that differ-
s in picture quality are far more
ous to the casual eye, than sound
ity to the casual ear.

e nominally black-and-white pictures
it a variety of hues according to
make and phosphor. They range
faintly yellowish pictures, through
ral grey to distinctly bluish ones
already I've heard quite spirited
ments as to which color is most rest-
o the eyes.

long similar lines are the arguments
and against tinted safety glass filters,
ral filters, clear glass, aluminised and
aluminised screens.

ne thing which has struck me is
complete lack of reference in such
ments to the color of the room
ing, or the room furnishings.

nless I'm much mistaken, screens
look a lot more blue, black or
dle according to whether the am-
t light is natural, incandescent or
escent; whether the room is decor-
in red, green or sky-blue-pink.

aven't you ever noticed how blue
street globes look when viewed
nst a deep red sunset. Yet most
s those same globes look a pretty
ly yellow.

ur ears aren't the only organs which
be conditioned and deceived.

hat about it, fellow viewers, or is it
early to have formed firm opinions?
ver and above picture color, I've
ced some terrific variation in picture
rast and brilliance among sets which
supposedly on display for prospective
hasers.

E SPECTRAL SPECIES

ve seen bright pictures with so little
rast that the scenes might well have
played by apparitions rather than
rs.

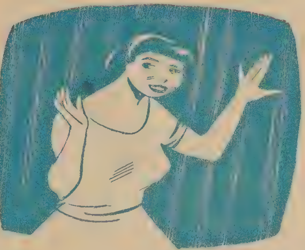
ontrariwise, I've seen the contrast so
ggerated that the result looked like
early black-and-white cartoon, or a
rch-hall shadow play.

In some cases the station has been
rly to blame because, without the
or sets being touched, the picture
assumed good, bad or indifferent
lities.

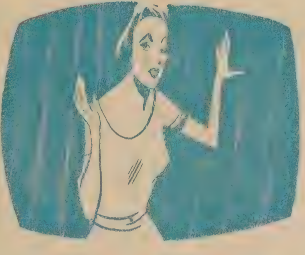
But the station certainly can't be
ned when, in a row of receivers,
picture quality varies drastically
n one to the other.

oth "brilliance" and "contrast" are
ssible normally as controls and one
eft in doubt as to whether the sales
onnel should be charged with indif-
nce, ignorance, bias or failing sight.
r is it just that the public can't read the little notices which say "PLEASE DO NOT TOUCH".

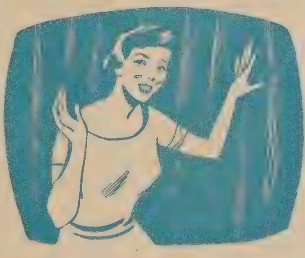
A MATTER OF ADJUSTMENT!



This . . . .



Or this . . . .



Or this . . . . ?

On the other hand, not all picture faults are amenable to such ready correction.

A few days ago, I came across a receiver of well-known make, displaying a test picture backed by a most luscious "herringbone" pattern. From what I could observe, the coarse tuning was wrongly adjusted so that, even with the fine tuning control at one extreme, a tone pattern from the sound channel was getting through on to the picture.

In the face of my query, the salesman was completely unperturbed.

"Oh, it's just the set", he said. "Many people like it that way."

According to him, the particular set had been sold only an hour or so before. The customer had stood back, looked at all the screens and demanded that particular set . . . because he liked the background pattern!

I wonder how he liked it later, when the pattern started to dance with the music?

I didn't make an issue of the matter in the crowded showroom and I don't know whether the salesman understood the finer points of tuning or of sound interference with the picture pattern.

If he didn't, he surely should have.

If he did, then I must say that he did a masterly job of turning a vice into a virtue.

And what about the misshapen pictures? What I said earlier may have been a trifle exaggerated but only a trifle.

Time and again, I've seen people with perfectly regular features become quite flattened on one side as they moved to the confines of the screen. I've seen faces distorted obliquely so that a perfectly honest smile becomes a twisted grin.

Presumably the reverse could happen, also!

To be sure, the station is sometimes to blame, presumably because of electrical of optical maladjustment of the camera. However, more than often, the fault is purely and simply in the receiver.

SHOULD BE ADJUSTED

Picture height, picture width and linearity in both directions are all subject to adjustment at the factory and again, if necessary, at the time of installation. The circle in most test patterns is there to enable the picture proportions to be pre-set, along with other details.

That they are not always correctly set is obvious from a comparison of pictures on adjacent receivers. People on the screen do tend to look stoutish or thinnish, tallish or shortish according to the setting of mysterious little control around the back of the set.

And, if listening to radio reproduction can distort our conception of music, what distortions and delusions are in store for the unsuspecting televiewer?

Will our womenfolk be led variously to seek a bean-like physique or dimpled dumpiness a la television set?

Or will they be found apeing that cute little gesture of the cooking expert, as she moves to one side of the screen, straightening her back, elongating her head and diminishing to an animated line.

All because of a faulty tubular condenser . . . in the set, I mean!

AUSTRALIAN TV IN 1929

Still on the subject of television, I have on loan from a reader several copies of an early Australian television magazine entitled Radiovision.

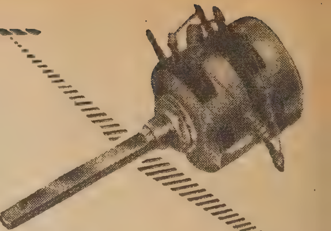
The reader's object in bringing these issues to my notice is to stress that the current television broadcasts are not, in fact, "The first in Australia".

Whether there is much point in pursuing such an argument is doubtful, in my mind, because the current broadcasts are undoubtedly the first in terms of high definition TV at an entertainment level.

However, it is interesting to recall that television experiments were being undertaken in this country at much about the same time as in England.

First issue of Radiovision, published by Television and Radio Laboratories Pty. Ltd., carries the dateline September, 1928. Along with odd snippets and an article on "Seeing by Wireless" is a list of stations in the US broadcast-

IRC AUSTRALIA



LOUDNESS CONTROL NOW readily available since first released 7 months ago!

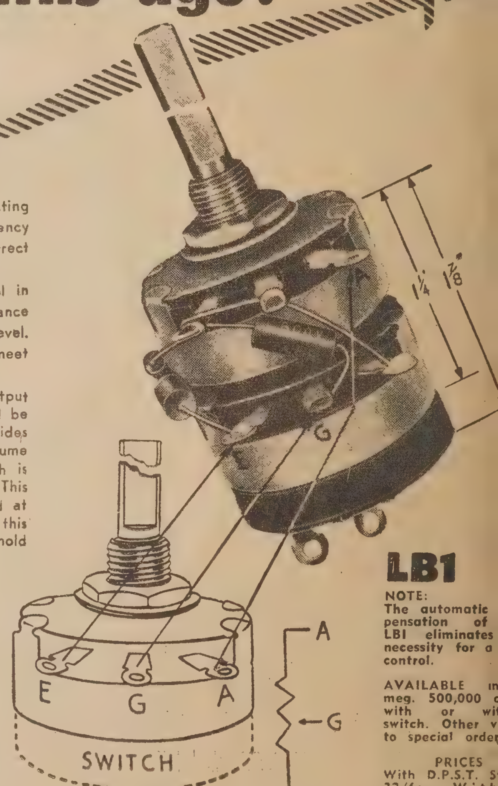
(Patent Applied for No. N11262)

The IRC Loudness Control is designed to replace your existing Volume Control and provides correct high and low frequency compensation as volume is reduced . . . and maintains the correct tonal quality right down to whisper level.

For many years there has been a need for a volume control in audio systems which would automatically keep the proper balance of all frequencies within the audio range at any listening level. I.R.C. has developed such a control, known as the LBI, to meet this need.

With the loudness control it is possible to reduce the output volume of any good or average system to a whisper and still be able to hear every tone with perfect balance, as the LBI provides gradually increasing high and low frequency boost as the volume is reduced to offset the deficiencies of the human ear which is insensitive to high and low frequencies at low volume. This accounts for the reason why many audio systems are operated at such high levels to give the best listening effect and in this process they become annoying to other members of the household and neighbours

The I.R.C. new loudness control consists of two separate volume controls operated from a single shaft of standard size and used with a combination of capacitors and resistors which are already wired. The unit will replace any volume control by transposing 3 simple connections, as indicated by the illustration at right. Can be fitted without experience.



PRESENT VOLUME CONTROL

LB1

NOTE:
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pensation of
LBI eliminates
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control.

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with or wi
switch. Other v
to special orde

PRICES
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Switch 26/6.
Available only
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Post this coupon today!

Please forward Loudness Control pamphlet giving detailed description and installation instructions.

NAME ....

ADDRESS ....

SUPPLIER (optional) ....

Sole Australian Agents.

Wm. J. McLellan & Co. Pty. Ltd.
126 SUSSEX STREET, SYDNEY — [illegible]
(50 yards from King St.)

DOESN'T AGREE WITH SERVICEMAN

Dear Sir,

Today is the day for me to see sparks, so I want to "buy an argument" with your "Serviceman Who Tells" over something he said in his November article (page 43).

He said that methylated spirit is "recommended by watch and camera mechanics as the best emergency treatment if one should be unfortunate enough to drop either of these devices in the water."—Quite so—if you are sure the water is fresh.

I once dropped a camera into the Derwent River, at Hobart. Assuming the water was fresh, I thought of the "bright" idea of immersing the shutter in methylated spirit, as suggested this month.

Hey, Presto! the water was removed, but the leaves of the diaphragm curled up like the petals of a dahlia; so the idea was a complete fahlia!

This experience stood me in good stead when another accident occurred some months later.

When washing the works of a mantel clock, one of the bottles of Shellite which I used was found to be a home-made caustic washing solution. So I immediately put the clock under the tap to wash it out, then washed it in methylated spirit, shaking the surplus off, and setting alight to the traces remaining in the clock. I then re-washed it in Shellite (without adding washing solution this time) and oiled it.

In case any of your readers should drop a watch or camera into salt water, it would be advisable to qualify the statement in the November issue.

Yours faithfully, C.L.

pictures experimentally on a regu-
basis.

n the broadcast band, stations are
tioned as being operated by General
tric, Western Electric, Chicago
y News, Browning Drake Co.,
o News and C. F. Jenkins.

ctures from the last-named station,
ved on apparatus of their own de-
were allegedly 10in square.

addition to the above broadcast
stations, seven short-wave "radio-
n" stations are listed, operating in
band 4700 to 4900 Kc.

ere is a note to the effect that no
vn radiodivision station was on the
at the time in Australia, though
ities were expected shortly.

OW BEING BROADCAST"

line with this, the February, 1929,
of the same magazine refers to
vision and television "such as is
being broadcast". It also contains
ne-page supplement showing the
le silhouette test patterns in use
the simple moving patterns pro-
d by a specially prepared movie

ewspaper clippings of later date tell
still picture transmission through
ourne stations 3DB and 3UZ,
techniques similar to those em-
ed in modern radiopicture apparatus.
e names which are quoted as the in-
tion behind these early efforts are
as Mr. Donald McDonald and
Gilbert Miles.

e years have moved on apace.
se silhouette images have given
to high definition (?) half-tone
res and the visionary zeal of ex-
nenters to the efforts of professional
eyors of entertainment and adver-
g.

t the spirit of experiment is not
, for the efforts of the same Mr.
ert Miles are featured in this issue,
g you how to capture modern TV
ges on the screen of a 5in CRO

owever, such is the story told by
magazine and the clippings referred
arlier.

ow many present readers can re-
ber "looking in" on these early
ts at "pictures by wireless".

ere they in fact "the first in Aus-
a"?

leave you to judge or to argue as
will.

LE-TASTE" IN 1958

st before folding up the mags. and
ing them away, it may be interest-
to quote a fictitious letter of pro-
written by an equally fictitious
iewer "thirty years hence". That
ens to be 1958, which must have
ed an awful long way off at the
—though not nearly so far away
where we stand now.

he letter refers to the problems of
e receiving programmes in terms of
and smell as well as sight and
d.

quote (with a few minor abbrevia-
s for the sake of brevity):

am disturbed at the results of in-
erence being caused nightly by
aste station 3AS. I use a five
bler set (particularly selective), but last evening, when we had a number of guests, and had arranged to flavor our drinks with clove flavor from 3LQ, a pernicious taste of beer began to seep in from 3AS. As my guests were all prohibitionists, this was particularly distasteful to them. I think the controllers of radio should take steps to prevent a continuance of these nuisances. I also think that broadcasting of alcoholic flavors should be prohibited, particularly on Sundays.

Yours, &c., I.W.T."

"EDITOR'S NOTE:

"Our representative interviewed the Political Head of the Department concerned, who declined to comment on the attitude of the Government concerning prohibitions on teletaste.

"Apart from the question of selectivity, a plebiscite taken by this paper indicated that beer occupied a high place on the list.

"We would suggest that I.W.T. employ a more selective circuit or else a wave filter or an intensifier, as the alcoholic group appear to be considerably stronger than cloves, lemon and like tastes."

Such, then, was their idea of fun and future in 1928.

Corny? Maybe. But what would your formula be for electronic activities in 1986?

ARGUMENT FOR SERVICEMAN

I should be thankful, perhaps, that other people than myself can buy an argument in what they write.

From a reader in Victoria comes a letter protesting against something written by our much-esteemed friend, "The Serviceman Who Tells".

Not being given to dropping watches or cameras in the drink, I cannot speak from any special experience or knowledge of the optimum treatment thereafter. However, for the sake of those who may enjoy this form of pastime, it may be worth our while to quote the letter of protestation, as above.

By way of conclusion, a correspondent raises a question which may have puzzled other readers.

He refers to the continuously variable tone controls which are seen on many modern amplifiers. You know the idea . . . bass and treble knobs with boost and cut positions at the extremes of their travel and "level" positions somewhere in between.

Our correspondent wants to know something about the calibration of these controls and whether the level position should fall at about the centre of the knob's arc of rotation.

In some cases, linear pots are used, in others the normal tapered variety, as used for volume controls. He is puzzled particularly by the latter choice, as the electrical centre of the resistance element would be nowhere near its mechanical centre.

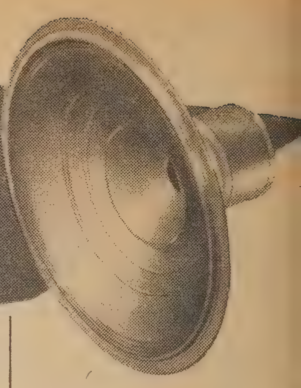
As one who has designed such circuits, I can say straight out that there can be no guarantee that the boost-level-cut characteristics of such a control will be symmetrical about its mechanical centre. This is one of the arguments advanced against a continuous control, as compared with a switch.

However, the designer usually does make an effort to see that the characteristics are as nearly balanced as possible. This involves a deliberate piece of compromise between the actual control, the amount of variation and the type of circuit.

The simplest case is where the general impedance of the "boost" circuitry is of similar order to that of the "cut" circuitry. Where it is, a linear pot can be used and the centre position will approximate balance and be "level".

Where, as is often the case, the impedance of the boost and cut circuitry differs, a different order of shunt resitsance is required for control purposes. This can be supplied by the characteristics of a tapered pot.

It is then a matter of manipulating component values to see that the "level" position occurs at about the centre of the knob's travel.



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This PHILIPS enclosure is designed for the 9762M speaker and combined they give an outstanding performance. The enclosure, however, can be used with any speaker having a bass cone resonance similar to our 9762M.

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Efficiency at 400 cycles	15%
Flux density	11,000 gauss
Total magnetic flux	133,000 oerstedt
Magnet weight	2.35 lbs.
Total weight	8 lbs.

Price £15/15/- inc. Sales T

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MORGANITE TYPE A Miniature controls are big enough to giv
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ACOUSTICS FOR HI-FI LISTENING

ligh-Fidelity reproduction has progressed to the stage when we can no longer ignore the ffects of room acoustics. Even if we cannot all reach the ideal, an understanding of what goes on can help us make the best of room conditions for good sound.

By M. ROSENFELD

IILE a hi-fi enthusiast may have spent considerable time, thought noney in acquiring the components s system, probably very little effort one into consideration of the acous- characteristics of the room where nusic is to be heard.

oustical conditions change the char- of each note as heard by the list- such as its duration and intensity. stic conditions also determine the bution of sound throughout the and the amount of power required the sound source. By proper con- of these conditions, the illusion of ence" can be obtained, as explained in the article.

ORTANCE OF PRESENCE

signers of auditoriums, sound os, lecture halls, etc., recognise this, eas the average hi-fi enthusiast has knowledge of the subject. Dealers gh-fidelity equipment should also be of the acoustic conditions in their rooms in order to display their mer- dise to best advantage.

ry frequently the same equipment sound different in one's own living than in the showroom, because of ing acoustic conditions.

is article will give the reader an eciation of the factors that influ- the acoustics of a room. In addi- a simple formula will be presented will enable the reader to calculate everberation qualities of his own ing room and ascertain whether actory acoustic conditions exist.

E" AND "DEAD" ROOMS

e acoustical engineer often speaks room as being "live" or "dead". refers to the amount of echo (also d reverberation) present.

example of a "live" room is a um gallery where the floors and are concrete or marble. When talks or takes a step in such a , the sound waves are reflected the walls, floor and ceiling, boun- around the room, echoing and re- ng, persisting for a relatively long

contrast, if one walks or talks in coustically treated theatre or studio, is little echo and sounds persist for a very short time. These are n as "dead" rooms.

ien a person is talking in such a , it sounds as if he were outdoors, there are no sound wave reflec- A person's ears are generally ac- med to listening to music and h indoors where a certain amount verberation is present. Music and h sound different outdoors because e absence of this reverberation.

ERBERATION TIME

e difference between a "live" room a "dead" room is the difference in me it takes for a sound to die out ch rooms. The walls, ceiling, floor, other objects in a room all absorb energy from sound waves striking them.

If the amount of absorption is large, as in an acoustically treated theatre, sounds will die out rapidly. If absorption is small, as in a marble museum gallery, sound waves will echo back and forth a number of times before their energy is finally absorbed. Therefore a sound will require a longer time to die out.

Acoustical engineers measure the "liveness" or "deadness" of a room by its reverberation time. Reverberation time is defined as the amount of time it takes for the energy of a sound wave to decrease to one-millionth of its original value in the room.

This definition is based on the fact that for the average person, this is the time it takes a sound of average intensity to decay to inaudibility in the room.

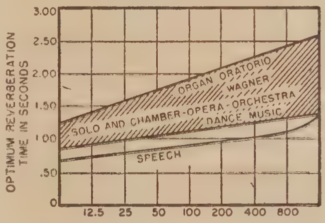


Figure 1—Optimum reverberation time for recording studios and concert halls for music, and for unamplified speech.

A highly reverberant or "live" room would have a reverberation time of about four or more seconds, while the reverberation time of a "dead" room would be about 0.3 second or less.

One can note the difference between the reverberation time of various rooms by simply clapping hands and noting how long it takes for a sound to die out. With a little practice, a rough comparison of the reverberation times of different rooms may be obtained.

EFFECT OF REVERBERATION

In addition to the primary source of sound in a room such as a person, orchestra, or loudspeaker, reverberation (in other words, echoing) introduces secondary sounds which modify the characteristics of the direct sound.

As far as speech is concerned, reverberation reinforces the primary source of sound so that less loudness from the person talking is needed.

However, if the reverberation time of the room is too long, overlapping of syllables occurs, because the reflected sound interferes with that coming directly from the person talking.

This causes syllables to become indistinct, speech to become garbled and the intelligibility of the speech suffers.

In music, reverberation in the room is also an important factor to consider and its effect depends upon the type of music.

For example, if dance music having short, clipped notes is played in a room or hall having a long reverberation time, reflected sound will interfere with notes directly from the orchestra, causing unpleasant listening.

On the other hand, an organ oratorio played in such a hall with a long reverberation time is enhanced.

Reverberation in a room also tends to distribute sound more evenly throughout the room, which is an important factor to consider if a large audience is present.

In addition, less power is required from an orchestra or loudspeaker for a given amount of loudness when the reverberation time of a room is larger.

OPTIMUM TIME

In rooms used for unamplified speech, such as lecture halls, classrooms and auditoriums, there is an optimum reverberation time. The compromise is between a long reverberation time giving higher volume and better sound distribution over the audience and a short reverberation time giving less overlapping of syllables and greater intelligibility of the spoken words.

The optimum reverberation time for unamplified speech has been found, by experience, to be about one second, more or less, depending on the room volume.

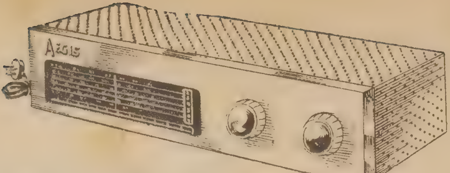
In rooms used for unamplified music, such as concert halls and recording studios, satisfactory acoustical conditions are subjective and a matter of individual preference. The preferred reverberation time is, to some extent, a matter of musical taste which depends

Varnished wood	**.07**
Parquet or hardwood flooring	**.07**
Heavy carpeting or rugs	**.40**
Thin carpeting or rugs	**.20**
Linoleum	**.02**
Plastered wall or ceiling	**.03**
Plywood wall	**.10**
Wooden doors	**.10**
Marble surfaces	**.02**
Wallpaper	**.04**
Glass window panes	**.10**
Open window	**1.00**
Curtains and draperies (heavy)	**.50**
Cotton curtains	**.20**
Concrete or brick	**.02**
Upholstered areas	**.50**

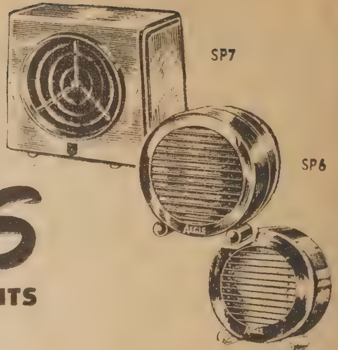
ABSORPTION OF COMMON OBJECTS
(in Sabine Units)

Person	**5.0**
Wood chair	**.3**
Small wood table	**.3**
Sofa, upholstered	**8 to 16.0**
Chair, upholstered	**4.0**

Table I—Absorption coefficients of common material and home objects (Sabine units).



AEGIS HI-FI TUNER



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RADIO PARTS AND COMPONENTS

Aegis parts are made in Australia to suit our conditions. Your guarantee of reliability is in the trade-mark, AEGIS!

AEGIS HI-FI TUNER: Latest Aegis development. Features newest circuit techniques and miniaturisation of components. I.F. Stage has band width nearly double that of ordinary receivers. Combined with any good treble boost circuit of an amplifier (preferably the Aegis-Mullard 5-10) will give the desired response from broadcasting stations. PRICE: £31.

AEGIS EXTENSION SPEAKERS: Modern plastic cabinets. SP7, 11½in x 4½in x 10¼in high (tapered). 7in speaker. Walnut or natural. PRICE: 139/-.
SP6, 4in x 7in (circular). 6in speaker. Black, Walnut Natural, Pink, Blue or Green. PRICE: 109/3.
SP5, 2in x 7in (circular). 5in speaker. Walnut or Natural. PRICE: 73/6

AEGIS-Mullard 5-10 HI-FI AMPLIFIER: Rated power output 10 W. Max 12-13 W. Frequency response + or − 0.5db, 10c/s to 20,000c/s. Output impedance standard 3.75 ohms and 15 ohms. Alternative impedances avail. Amp.: 11¼in x 6½in x 6in. Tone Control Panel: 12in x 3in x 1¾in. PRICE: £54/5/-. Also in Kit form, PRICE: £36/15/-.

M18 AEGIS SIGNAL MAGNET (Loop Aerial). Insulated flexible mount. Ferroxcube Rod—possesses extremely high degree of permeability. Improved selectivity and sensitivity. PRICE: 24/6.

MF1 AEGIS MAINS FILTER. Eliminates interference coming through electrical mains. PRICE: 56/-.

MF2 LINE FILTER. Extra inductances for greater efficiency. PRICE: 69/3.

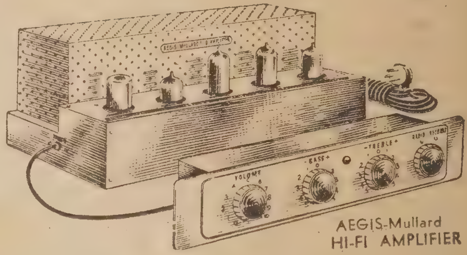
AF1 AEGIS AERIAL FILTER SYSTEM. Completely dispels noise interference in both broadcast and shortwave. Aerial wholly assembled. Complete instructions. Boxed. PRICE: 192/9.

COILS AND I.F.s. M9 Coils B/C aerial; M11 Coils B/C osc. 6AN7, 6J8G; M10 Coils B/C RF, 6BE6, 6AE8; All priced at 17/9 ea. I.F. Transformers—J9 intermediate 455KC No. 1; J10 intermediate 455KC No. 2; priced at 19/3 ea.

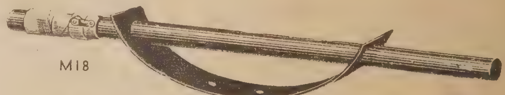
AEGIS TUNING KNOBS MV12 Concentric 2-piece, PRICE: 2/6. MV11, 1in diam. PRICE: 1/4. MV10, 1¼in diam. PRICE: 1/4. MV9, 2 1/8in diam. PRICE: 2/1. All available in walnut or cream.

AEGIS TUNING POINTER. Black bakelite, metal insert. PRICE: 1/4. Heavy duty Pointers, brass insert. PRICE: 2/-

PACKAGED HARDWARE including assorted nuts, bolts, cored solder, etc. PRICE: 3/- pkt.



AEGIS-Mullard HI-FI AMPLIFIER



M18

MF1

AF1

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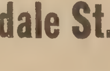

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e compositions, the conductor's in-
tation, the musicians, and the list-

asurements of the reverberation
of the leading concert halls in Eur-
nd the USA, judged to be acousti-
satisfactory by musical authorities.
been made.

se measurements indicate that sat-
ory acoustical conditions result
the reverberation times range from
ximately 1 to 2.5 seconds, depend-
the room volume and the type of
. Acceptable limits for both
and music as a function of
volume are shown in Fig. 1.

tors such as loudness and uniform-
sound distribution can be readily
lled in rooms where speech and
are reproduced by amplifier and
eaker systems such as in motion
theatres, auditoriums with PA
s and one's own living-room.

refore, such factors need hardly
into a determination of optimum
eration time for these rooms.

effective reverberation heard by
stener in such rooms will be a
nation of that of the studio where
eech or music originated and the
where the speech or music is

RBERATION TIME FOR HI-FI

listening room should not add to
verberation of the music emanat-
om the studio, so the listening
reverberation time should be
ely short.

vever, if the listening room is ex-
ely deadened, then most of the
heard will be that coming directly
the loudspeaker, which is too di-
al to sound natural. It will
as if one were listening to the
eaker out-of-doors where no ob-
such as walls or ceiling, are pres-
reflect sound waves.

uitable reverberation time for a
ng room is approximately 0.3 to
cond.

reverberation time of the listen-
om can, to a great extent, give
tener the illusion of "presence".
example, if an announcer is speak-
a studio having a very short re-
ation time, the listener is an
ry room has the impression that
nouncer is present in the listen-
om since the reverberation of the
ng room will be predominant.

vever, if the studio has a consider-
onger reverberation time than the
ng room, the listener has the im-
n that he is actually in the studio.

meet the requirements of different
m material, many studios have
e reverberation time characteris-
tained by the use of removable
ical wall panelling. Interesting
l effects can be obtained by the
"echo" chambers and electrical
s which artificially introduce re-
ation into a musical composition.

following examples illustrate how
verberation times of the studio
e listening room combine.

studio has a reverberation time
second and that of the listening
is 0.4 second, the resultant re-
ation heard by the listener will be
0.6 second, an increase of about
c over that of the studio.

ne studio has a reverberation time
seconds and that of the listening
0.4 second, the resultant rever-
beration will be about 1.65 seconds, an increase of about 10 p.c. over the studio.

These figures illustrate that since the optimum reverberation time for music studios is about 1 to 2.5 seconds, a listening room reverberation time of about 0.3 to 0.6 second will have little influence upon the reverberation qualities of the original music.

In modern motion picture theatres, the designers have purposely made the reverberation times low (0.6 second or less) permitting the originating sound studios to introduce the desired reverberation time.

For a cathedral setting, the reverberation time introduced by the originating studio is made long.

For an outdoor setting, it is made short or zero. It should be noted that once reverberation has been introduced into the recording, it cannot be removed at the listening room, but can only be made greater.

For hi-fi listening, it is desirable that the studio where the music was originally recorded or played contribute the major part of the reverberation introduced. Therefore, the listening room should have a reverberation time of 0.6 second or less, since its effect on the reverberation qualities of the music will then be negligible.

Ceiling (plastered)	16′ x 12′ x .03	5.76
Floor (parquet)	16′ x 12′ x .07	13.44
Walls (2 plastered)	16′ x 9′ x 2 x .03	8.64
Walls (2 plastered)	12′ x 9′ x 2 x .03	6.40
Window panes (2)	2′ x 5′ x 2 x .10	2.00
Wooden door (1)	3′ x 7′ x .10	2.10
One person in room		5.00
	Total absorption = A =	43.34 Sabine units.

Ceiling (plastered)	16′ x 12′ x .03	5.76
Floor (heavy carpeting)	16′ x 12′ x .40	76.80
Walls (2 plastered)	16′ x 9′ x 2 x .03	8.64
Walls (2 plastered)	12′ x 9′ x 2 x .03	6.40
Heavy drapes over windows (Windows not included since they are covered and not a factor)	2′ x 5′ x 2 x .50	10.00
Wooden door (1)	3′ x 7′ x .10	2.10
Sofa (medium size)		12.00
Upholstered chairs (2)	4 x 2	8.00
End tables (2)	.3 x 2	.60
Three persons in room	5.0 x 3	15.00
	Total absorption = A =	145.30 Sabine units.

Top—Table 2. Absorption of various parts of an empty listening room.

Bottom—Table 3. Absorption of the various parts of a household listening room with the normal complement of furniture.

DETERMINING REVERBERATION TIME

Reverberation time of a room is best measured by introducing a sound wave into the room, shutting it off, and recording the decreasing level as a function of time, using a suitable recorder.

The decay of sound can then be measured.

This method requires extensive apparatus and measuring equipment. However, by means of a simple formula, it is possible to calculate the reverberation time of a room which is adequate for all practical purposes.

The formula states that reverberation time of a room is in direct proportion to the volume of that room and in inverse proportion to the total amount of absorption caused by the surface areas of walls, floor, ceiling, and all objects

Ultrasonic Unit Makes Better Joints

POLYVINYL ACETAL ENAMEL insulation is removed and wire is soldered to coil terminals in a single fast operation through use of high-power ultrasonic soldering equipment developed by Aeroprojects Inc., West Chester, Pa. Without stripping and without the use of flux, the ends of the wire are securely soldered to the pretinned copper terminals.

By the hand stripping method the stripped part of wire is often not even wrapped around the terminal; instead, the insulated wire is placed in contact with the terminal. Then, by normal soldering methods, a bad joint would usually result.

By ultrasonic soldering with equipment powerful enough to remove the insulation, the soldered joint can be made successfully every time because the human element has been eliminated. The wire is stripped and soldered where the connection is required.

After wrapping the wire around the terminal, the assembly is dipped into a soldering pot containing 60-40 or 50-50 tin-lead solder at approximately 650 F. The terminal ends are brought up close to the tip of an S-3-H-55-8 Sonobond unit. This ultrasonic soldering head, in conjunction with a specially designed tip, delivers the ultrasonic energy where it is most effective to do this operation. In less than two seconds, the two terminals are stripped and soldered. The operation is accomplished at a temperature which insures a good connection yet not so high as to damage the wire.—Electronics.

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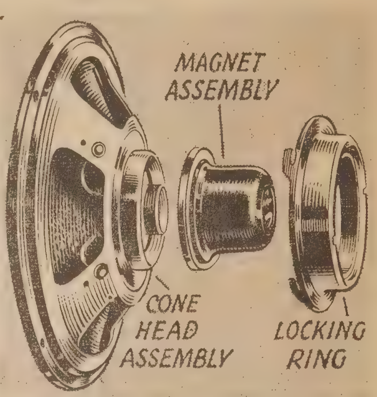

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6P2	£2/8/10	12P1	£3/12/8
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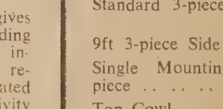

TRADE AL
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●
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MORNIN

PLEASE INCLUDE POSTAGE OR FREIGHT WITH ALL ORDERS he room. It is as follows:

= .05 (V/A)

re: T=reverberation time in seconds
V = volume of the room in cubic feet
A=total room absorption (in Sabine units)

LCULATING TOTAL SORPTION

he total absorption of the room is ulated by multiplying each exposed ace area (in square feet) in the room its respective absorption coefficient. he surface of every object in a room ch is exposed to sound waves, i.e., ls, floor, ceiling, chairs, tables, pes, rugs, &c., will absorb some sound e energy. Some materials absorb nd waves better than others.

or example, a cloth drapery absorbs nds better than a marble table top. ability of the surface of a material bsorb sound is known as its absorp- coefficient.

bsorption coefficient is defined as the o of sound wave energy absorbed by surface of the material to sound wave gy incident upon the material. There- if a material has an absorption ficient of 0.9, it is an excellent sound rber and little sound wave energy is ected from it.

n the other hand, if a material has absorption coefficient of 0.05, it is oor sound absorber, and 95 pc of the dent sound waves will bounce back n its surface.

he surface of all objects in a room e sound absorbencies which can be sured and rated between 0 and 1.00. absorption coefficients for common erials are given in Table 1.

SORPTION COEFFICIENT

he total sound absorption of a sur- depends upon its area and the ob- ption coefficient of the material.

or example, if a panel measuring r square feet has an absorption co- ient of 0.1, the total absorption is 0.1 or 0.4 Sabine unit. If another el has an area of 1 square foot, but an absorption coefficient of 0.5, the l absorption would be 0.5 Sabine

herefore, although the area of the er panel is smaller, it has greater nd absorbency.

person's clothes and exposed parts his body, such as face and hands, absorb sounds. The total absorp- of a person in a room has been sured and found to be approximately Sabine units. The unit of total ab- ption is the "Sabine", so named in or of W. S. Sabine, who developed formula given earlier.

TERMINING REVERBERATION

o illustrate application of the nula, let us first consider an empty g room 16ft long by 12ft wide by high, having plastered walls and ing, two window panes, each 2ft wide 5ft high, and parquet hardwood floor-

he total absorption of each surface in room is found by multiplying each ace area in square feet by its respec- absorption coefficient obtained from le 1. The total absorption of com- objects in the room such as a per- a chair, a sofa, is also listed in the e so that no multiplication by sur- area is necessary for these objects. total absorption of the various parts he room is given in Table 2.

Substituting the figure 43.34 Sabine units (Table 2) for A in the formula, we find that the reverberation time of the empty room with the windows and door shut and one person in the room is:

$$T = .05(V/A) = .05 \times \frac{16' \times 12' \times 9'}{145.3}$$
$$= 0.6 \text{ second}$$

Let us now consider this same living-room only furnished with wall-to-wall carpeting on the floor, heavy drapes hung over the windows, a sofa of medium size, two club chairs fully upholstered; two end tables, and three people in the room. The total absorption of the various exposed surfaces in this room is given in Table 3. The reverberation time of the room so furnished is:

$$T = .05(V/A) = .05 \times \frac{16' \times 12' \times 9'}{43.34}$$
$$= 2.0 \text{ seconds}$$

PURNISHING A LISTENING ROOM

1. Cover bare walls and windows with drapes and curtains over as large an area as practical.
2. Use heavy drapes and curtains rather than those of lighter weight materials.
3. Cover floors with carpeting where possible and have the carpeting as heavy and as deeply napped as possible.
4. Furniture should be distributed uniformly around the room rather than concentrated in one area, to insure uniformity of sound distribution.
5. Large rooms require more draperies, carpeting, and furniture in proportion to small rooms, to decrease their reverberation times.

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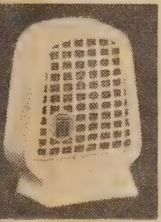

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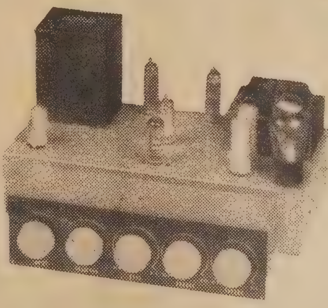

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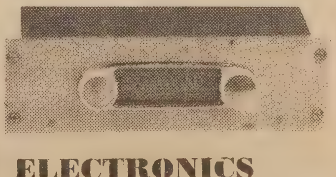

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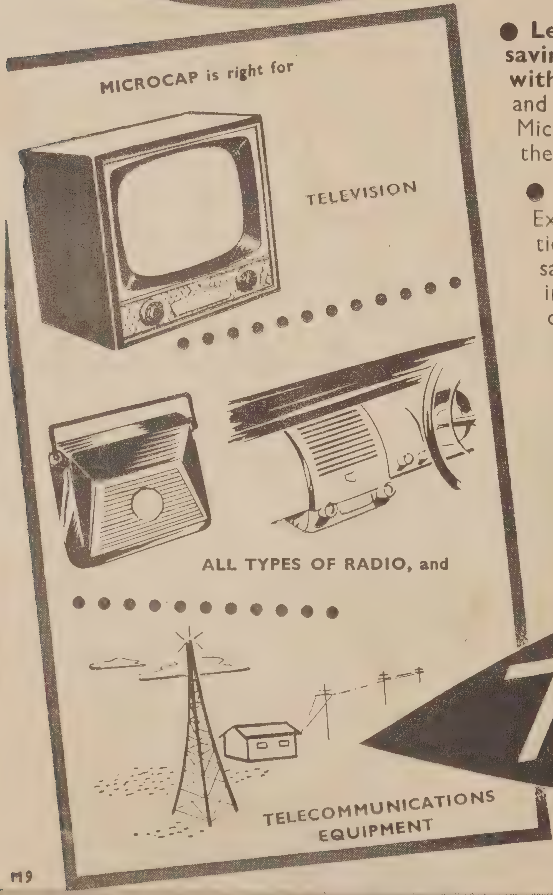
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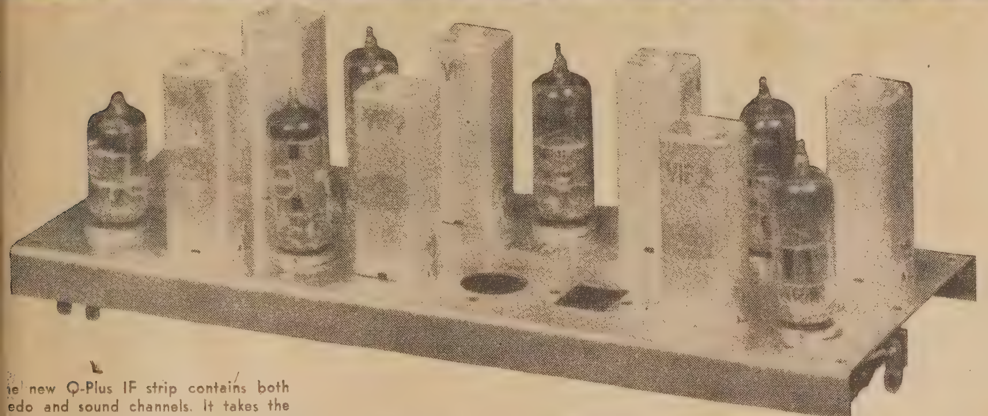


ie new Q-Plus IF strip contains both edo and sound channels. It takes the ignal from the tuner and delivers video n audio signals to the appropriate amplifiers.

COMPLETE Q-PLUS IF STRIP

A great deal of the current research and design in radio factories is directed towards the development of components for use in TV receivers.

HE day of full-sized home-built television receivers s been brought a step closer the release of a complete, e-aligned vision and sound IF ip by Messrs. R. W. Steane Co. Pty. Ltd., of Auburn, Vic.

esignated as the Q-Plus Video and nd IF Strip, Mark I, the unit comes nplete with 7 valves and is ready ed, tested and fully aligned.

he constructor simply needs to make requisite cut-out in the main chassis, unt the unit and connect to it the ver supply leads.

t is designed to receive a signal input from the tuner section through a coaxial cable. From the output end emerges audio and video signals, suitable for application to the audio and video amplifiers in the main chassis. A complex and important part of the receiver is therefore disposed of at one stroke.

The circuit and instruction leaflet supplied with the unit indicates that it uses a combination of double-tuned and bifilar transformers. Sufficient data is given to allow alignment to be carried out on any future occasion, should valve replacements, etc., make this desirable. The final curve, as depicted, conforms quite closely with the ideal.

Trap circuits are inductively coupled.

Normal valve complement comprises four 6CB6 in the main IF channel, a 6AU6 as sound IF amplifier and two 6AL5 duo-diodes as detectors. Additional valves and components can be added, should more effective limiting be required, as in poor service areas.

At the time of writing, no extensive tests have been practicable. However, a specimen unit was wired into a developmental chassis, coupled to a commercial tuner and the sound side of the programs received immediately, without any adjustment whatever.

GOODMANS IMPROVE REFLEX

The Goodmans Acoustical Resistance Unit has met with much success overseas, and it is claimed that t allows reduction in size of a Bass Reflex cabinet y as much as one third without prejudice to performance.

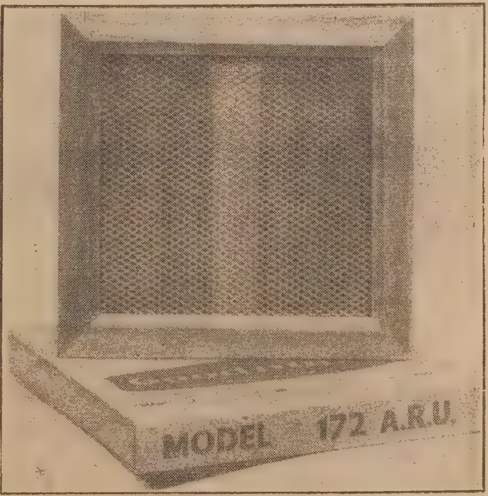
fact Goodmans say that, using the unit, the results from the smaller cabinet are better than from the larger.

The theory behind the unit is too long to consider here, it consists of a device fitted into a wooden frame which nounted in the cabinet in the same position as otherwise upied by the normal vent. It comes in several sizes, three them for combinations of the Axiom 80 speaker, and a rth intended for use with the Axiom 22 and 150 models, well as the Audiom 60 and 70.

The latter pre-supposes an enclosure volume of 7800 ic inches, with an aperture of 10½in by 10in.

The frame, which is 2in deep, is fastened to the cabinet n the front and is quite neat in appearance.

A test made of an enclosure as recommended fitted h one of these units and an Axiom 150 showed that re was no lack of smooth bass response. Even down to cycles, the cabinet gave a performance usually expected m those of much larger size.



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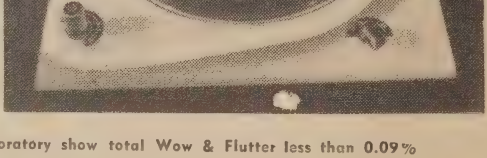

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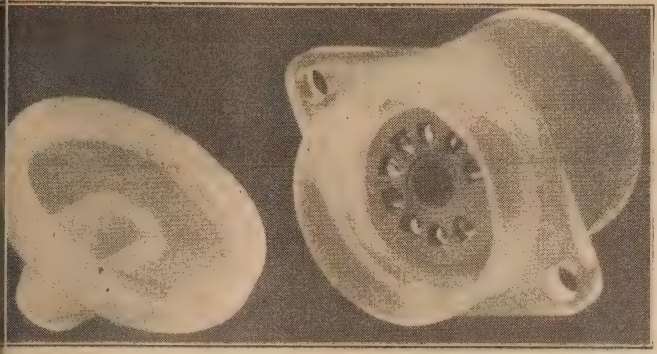
'or E.H.T. rectifiers in television receivers, Messrs. Wm. J. McLellan ι Co. Pty. Ltd. have released two special sockets, both designed to withstand the extremely high peak voltages encountered in this service



HE socket pictured above is designated as type ST109C. It is a mica-d noval type but mounted in a poly-ie shroud, as illustrated. A separate :-cap is supplied to protect the base ng during service.

: second type of socket, ST108L, is the octal variety, mica filled and ılded in one piece with a shroud. It is claimed, in fact, to be the largest mica-filled moulding currently made in Australia.

Both sockets are capable of operating at potentials of at least 16KV, as used in current 17in television receivers.

Supplies of both sockets are now available from trade houses. The ST109C retails for 4/- and the ST108L for 9/4.

NEW BOOKS

ROM MICROPHONE TO EAR, G. Slot, Philips' Technical Library, ular Series. Soft cover, 8¼in by , 170 pages.

wealth of the latest information of rest to record lovers and high fidel-enthusiasts is contained in this little k which seeks to trace the disc re-ling and record reproducing system ı beginning to end.

he object is achieved in such a sing manner than we imagine most quality fans will have difficulty in ng the book down before reading ight through and re-reading parts pecial interest.

lthough it deals with a subject ch is, in fact, highly complex, the k is written in such a way that it serve as an introduction to non-nical people. At the same time, e is sufficient "meat" in the form of tical advice on the handling of rds and record playing equipment nterest experienced technicians.

he discussion on the relative merits liamond, sapphire, steel and special ys as stylus materials is but one nple of the clarity and depth of the rmation contained in the book. Here points involved in the choice of are summed up in a few para-hs. Yet on re-reading this section ould not reasonably be said that important points had been left out.

The book has obviously been written by a man with a wide experience and love for the subject.

Our copy direct from N. V. Philips' Gloeilampenfabrieken Eindhoven Holland.

TRANSISTORS, GERMANIUM AND SILICON DIODES, published by Philips Electrical Industries Pty. Ltd. Paper cover, 8½in by 5½in, 120 pages. Local price 5/6.

Produced locally and therefore covering semi-conductor devices now available and likely to be available in the future, the third edition makes a useful contribution to the subject.

The book contains data sheets on nine transistor types including the OC44 and OC45 with current amplification cut-off frequencies in the grounded base circuit averaging 15 Mcs and 6 Mcs respectively. Supplies of these types cannot be guaranted at the moment but local publication of the data is encouraging.

Data for 13 semi-conductor diodes of which three are silicon types also appears.

The characteristic sheets are supplemented by descriptions of a number of practical projects including oscillators, multivibrators, a DC converter, an audio amplifier and a geiger counter.

The table of transistor ratings which compares locally available and a number of American types will be found useful when the book is read in conjunction with some of the standard American textbooks.

An excellent introductory article by J. J. A. Plos van Amstel of Philips Research Laboratory, Eindhoven, on transistors included in the book is well worth careful reading (M.V.F.)

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

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Goodman's Axiom 150 Mk II	£26/8/3
Wharfedale W10/CSB	£25/5/6
MSP Twin 12in 2½in	£17/12/6
Peerless Coaxial 12in	£16/17/6
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1764	,,	,, ,, ,,	325 — CT — 325	
1765	,,	,, ,, ,,	385 — CT — 385	
1766	125	,, ,, ,,	285 — CT — 285	
1767	,,	,, ,, ,,	300 — CT — 300	
1768	,,	,, ,, ,,	325 — CT — 325	
1769	,,	,, ,, ,,	350 — CT — 350	
1770	,,	,, ,, ,,	385 — CT — 385	
1771	150	200 — 230 — 240	285 — CT — 285	5v—3A; 6.3v—2A; 6.3v—CT—2A.
1772	,,	,, ,, ,,	325 — CT — 325	ditto
1773	,,	,, ,, ,,	350 — CT — 350	5v—3A; 6.3v—3A; 6.3v—CT—3A.
1774	,,	,, ,, ,,	350 — CT — 350	5v—3A; 6.3v—CT—3A; 2.5v—5A.
1775	,,	,, ,, ,,	385 — CT — 385	5v—3A; 6.3v—3A; 6.3v—CT—3A.
1776	175	200 — 230 — 240	285 — CT — 285	All in this Section 5v—3A; 6.3v—3A; 6.3v—CT—3A.
1777	,,	,, ,, ,,	325 — CT — 325	
1778	,,	,, ,, ,,	350 — CT — 350	
1779	,,	,, ,, ,,	385 — CT — 385	
1780	200	,, ,, ,,	350 — CT — 350	
1781	200	,, ,, ,,	400 — CT — 400	
1782	200	,, ,, ,,	450 — CT — 450	
1400	250	200—220—230—240	565, 500, 425 A side	2 x 6.3v—3A; 2 x 2.5v—3A; 5v—3A.
1371	300	,, ,, ,, ,,	1000, 850, 750, 600, 500 A side	— — —

TYPE 931-15: 20 watts.
Prim.: 4500 ohms P.P
Sec.: 3.7 or 15 ohms.
Resp.: 10-60,000 cps.
Valves: EL37, KT66. 6L6, etc.
19% Screen Taps.

TYPE 931-8: 20 watts.
Prim.: as 931-15.
Sec.: 2 or 8 ohms.
Resp.: As 931-15.
Valves: As 931-15.
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Sec.: 3.7 or 15 ohms.
Resp.: 10-60,000 cps.
Valves: 807, KT66, etc
19% Screen Taps.

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Prim.: As for 921-15
Sec.: 2 or 8 ohms.
Resp.: As 921-15.
Valves: As for 921-15.
19% Screen Taps.

TYPE 916-15: 12 watts.
Prim.: 8500 ohms P.P.
Sec.: 3.7 or 15 ohms
Resp.: 10-50,000 cps.
Valves: 6BW6, 6V6. KT61, etc.
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TYPE 916-8: 12 watts
Prim.: As 916-15.
Sec.: 2 or 8 ohms.
Resp.: As for 916-15.
Valves: As for 916-15.
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TYPE 949: 12 watts.
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TYPE 870 — 6 watts.
Prim.: 10,000 ohms P.P
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(for "Rola" 120X)

TYPE 871 — 12 watts
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Sec. 2 or 8 ohms.

TYPE 872 — 12 watts.
Prim.: 10,000 ohms P.P.
Sec.: 3.7 or 15 ohms.

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TYPE 763 — 15 watts.
Prim.: 5000, 300 ohms P.P.
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TYPE 920 — 15 watts.
Prim.: 5000, 3000 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms.

TYPE 897 — 15 watts
Prim.: 10,000, 8000 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms.

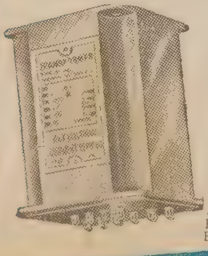
TYPE 896 — 15 watts
Prim.: 10,000, 8000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

TV KIT

(Designed for use in T.V. Circuit. Published by Philips Elect. Ind. P/L.)
P.T. 1790: P: 200, 230, 240V; S: 230-CT-230, 350 mA; F: 2 x 6.3V at 6A.
O.T. 2507: To Philips Specification.
Z 1090: 3 Hys-300 mA Choke, D.C. Res. 50 ohms.

MATCHED KIT (For Mullard 20W EL34 Amp.)

P.T. 1783: P: 200-230-240v., 50cps.
S: 410-CT-410v., 180 mA.
F: 5v-3a; 6.3v.-CT-4A; 6.3v.-CT-2.5A (Electrostatic Screen)
Z. 1092: 10 Hys-180 mA Choke; D.C. Res., 200 ohms.
O.T. 921: See above. Tested and approved for use in this Amp., by Technical Service Dept of Mullard (Aust.) Pty Ltd.



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PHILIPS RELEASE WIDE-RANGE SPEAKER

.atest addition to the range of wider range speakers comes from 'hilips, an attractive unit made in Holland which has a remarkable sensitivity.

fact the figure of 15 per cent at 400 :ycles must be the highest claim- 'or any current speaker in its class.

'e have no means of verifying the ıracy of this specification, but when nected to an amplifier and com- ed with other speakers on a listening the Philips gives at least as much out from the same input as the best ts contemporaries.

his makes it a valuable unit when wattage amplifiers are not avail- and high output is called for.

he speaker is of the twin-cone type, a big magnet and a 20-watt rat- The voice coil is 6/8 ohms, a ırture from the standard 15 ohms used. But with a high-feedback lifier this is not a highly important ter, although 8.4 ohm transformers available.

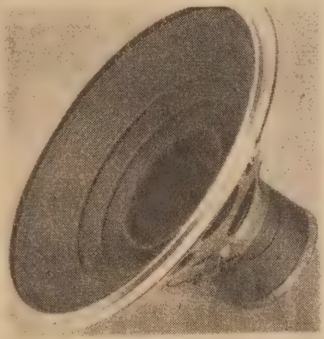
CYCLE CONE

he cone resonance is 45 cycles, claimed response is from 35—18,000 es.

n test the speaker gave very good response, indicating that it would vell worth mounting in a large en- ure, although we used one about recommended size. Reproduction eared to favor the middle range, giv- remarkably good presence. Roll- at the extreme top is gradual.

ot the least attractive point about the speaker is its price of £15/15/9, retail. At this price it might be hard to beat in competition for all but the upper quality bracket.

Philips can also supply polished or unpolished enclosures for this speaker, and will sell the complete assembly at £45/5/10.



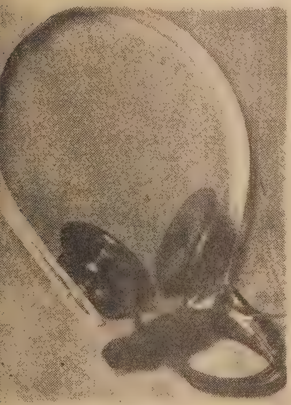
The new Philips twin-cone speaker sells for £15/15/9. It has remarkable sensitivity.

The size of the enclosures is 36in high, 19in wide, and 17in deep. The weight of the enclosure alone is 42lb. Walnut, mahogany and maple finishes are available.

Price of the unpolished enclosures is £25/8/6, and polished £29/5/10. All prices include sales tax and availability is now.

Philips advise that immediate delivery of these speakers can be made.

EADPHONES FROM R. W. STEANE



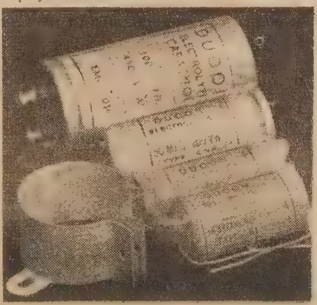
N interesting addition to the line of Q-plus components are the head- ıes pictured above. Light in weight of modern design, the phones should ust the thing for small-set construc-

ıe headband is a single, plated ıg-metal strap, with slotted ends h will give plenty of adjustment heads of different size and shape.

ternally, the phones are of novel truction, using a large single coil centre magnet. A standard cord is ided with tip-jack terminals.

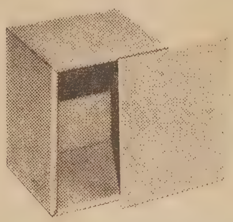
DUCON ELECTROLYTICS RANGE FOR TV SETS

TO meet the special requirements of television receivers, the Ducon Company has added many new electrolytic capacitors to its range. Two typical units are shown in the accompanying group; one of these carries the rating 100mfd 350VW and is suitable as a main HT filter. Another, rated at 50mfd and 200VW is well suited to filter the subsidiary circuits. Combination units are also available while "conventional" values are much reduced in physical size.



METAL UTILITY CABINETS

NEW PRICES—NEW SIZES



This line of cabinet is for housing electronic equipment of all types. It has removable front, or back, or both. Basic colour is grey.

Catalogue No.	D.	W.	H.	Price Plus Sales Tax		
MC6	6in	6in	6in		10	3
MC5	5in	6in	9in		11	4
MC7	7in	8in	10in		15	9
MC67	6in	7in	12in		17	9
MC81	8in	10in	10in	£1	1	0
MC82	6¼in	13in	8in	£1	5	0
MC83	6¼in	13in	10in	£1	7	0
MC811	8in	11in	12in	£1	5	0
MC79	7in	9in	15in	£1	7	0
SLOPING FRONT CABINETS						
SF7	7¼in	6in	6½in		14	6
SF79	7¼in	9in	6½in		17	9
SF71	7¼in	11in	6½in	£1	0	0
SF8	8½in	13in	8in	£1	4	0
SF10	10½in	18in	10in	£1	18	3
Scope cabinet, chassis, etc				£5	10	0
SPEAKER BOXES						
5in hole	7in	7in	4in		16	3
6in hole	8in	8in	4in		19	3
8in hole	10in	10in	6in	£1	1	3

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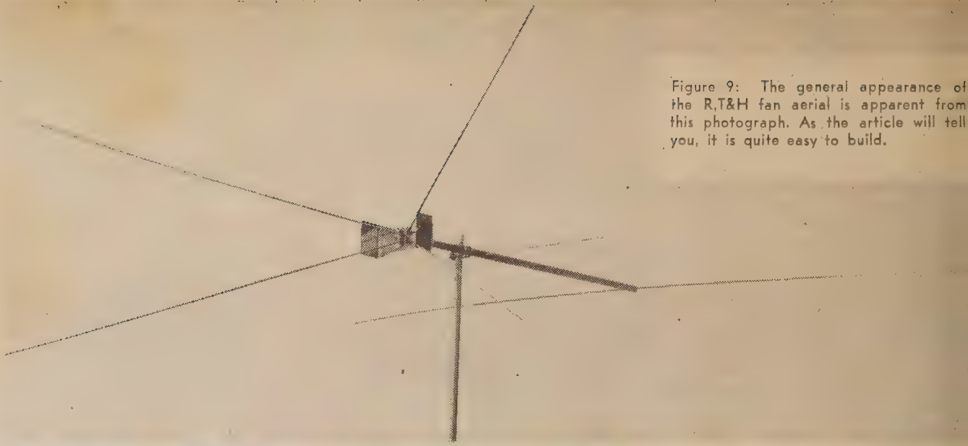

Figure 9: The general appearance of the R,T&H fan aerial is apparent from this photograph. As the article will tell you, it is quite easy to build.

BUILDING YOUR OWN TV AERIA

If you can handle ordinary metal-working tools, you can build your own FM-Television aeria in a few hours of spare time. In the process, you'll save several pounds, even if you have to buy every nut and bolt that goes into its construction.

LAST month we discussed, at some length, the general design background of VHF aerials which, of course, includes those for FM and television reception.

We explained about resonant element lengths, reflectors, directors, impedance, feedlines and methods of increasing aerial bandwidth. We suggest that you study this first article so that, when you actually start to put something together, you won't be working completely in the dark.

In the light of this first article, you may already have decided that you won't require an outside aerial. You may live in an area where signal strength is very high and where "ghost" images are not likely to be a problem.

SIMPLE DIPOLE

In such a case, there may be no need to use more than a simple dipole on the picture rail, or, better still, underneath the gable of a tiled roof. Plenty of viewers have found that they get adequate signal from such a dipole cut for about 190 Mc. and intermediate between Channels 7 and 9.

Enough was said in the first article to allow readers to work out such simple aerials for themselves. In any case, there is so little to them that elements can be varied in length and position almost at will.

Our immediate problem here is to describe an aerial for use in localities where the signal is only fair to average; to produce an aerial equivalent to those being sold commercially and which is able to give a good account of itself on all the required channels, in terms of signal pickup and directivity.

As will be evident from previous discussion, this is a rather tall order, because resonant VHF aerials are naturally "selective" devices, which tend to lose their efficiency and their directional properties when used to receive signals at other than their resonant frequency.

MANY ANSWERS

In their attempts to reconcile the conflicting problems of gain, bandwidth, directivity, &c., commercial designers have come up with a wide variety of answers—fans, X aerials, multiple beams, curtain arrays and so on.

Very few such television aerials are the outcome of pure electrical design. The approach, almost invariably, is to apply a basic idea and a few basic dimensions to produce a prototype.

This is then subjected to field-strength measurements, to observe its performance on the various channels. Elements are trimmed, bent and moved about until an acceptable compromise result is obtained. It then goes into production.

PART TWO

In some cases, the dimensions may be biased deliberately to suit the service area in which the aerial is to
installed. If it is known that an ae
will be used mainly for Channel 1
perhaps Channels 4 and 5, it may
differ in detail from one intended
the Channel 2-7-9 combination alloc
in the Capital Cities.

We are often asked which is
"best" but, even if we had the time
facilities to analyse them all, it wo
be near to impossible to produce
unqualified answer.

Some aerials are relatively simple
cheap, yet adequate for non-complic
situations.

Others have good, average, all-b
characteristics though, perhaps, not
best where interference problems
mand optimum vertical or horizo
directivity.

Still other aerial arrays have the
sired directivity characteristics but
on certain channels. Their performa
on any other channels may well pr
to be disappointing—if and when t
are usefully occupied.

And, of course, there are those ae
arrays which do lay claim to all-cha
operation, with quite impressive fig
of gain and directivity. Cost and c
plexity are normally equally impress

"AVERAGE" DESIGN

In selecting a type of aerial for h
construction, the obvious course is
choose something with "in-betwe
characteristics, neither too elemen
nor too complex, suitable for ave
locations and easy to assemble.

The "fan" type aerial fits the
quite nicely.

It presents no special problems in re-ard to feeder connection and dimen-ons are not very critical—as will be vident from the variations between ommercial units.

In the light of last month's article, may be helpful to examine the fac-rs which determine the general dimen-ons of a fan aerial suitable for use ithin the service area of Sydney or Ielbourne television stations.

Key to the operation of a fan aerial es in the fact that, if the dipole is ıt to one half-wavelength in the 60-)Mc region, it will be equal to three alf-waves in the 200Mc region. It can ıerefore have a natural or a harmonic esonance adjacent to channels 2, 7 nd 9—as allocated in the capital cities.

CTUAL FIGURES

This is merely a general statement. efore actual element lengths can be alculated, it is necessary to settle upon ome compromise figure of frequency which the elements shall nominally resonant.

Centre frequencies for channels 7 ıd 9 are respectively 184.5 and 98.5Mc, the "average" of the two work-g out at 191.5Mc.

If we assume that any compromise gure should favor the higher frequency ıannel, it is reasonable to suggest a gure of 193Mc. In other words, the ısic dipole element should have an verall length equal to three half-aves at this frequency.

Use can now be made of the formu-s given last month.

In an aerial three (or more) half-aves long, the 5 pc "end-effect" cor-ction is not applied to all sectors since, ter all, it still only has two ends. ıerefore the total length of the dipole orks out at 492/193ft, plus 492/193ft, us 468/193ft.

This gives 2ft 6½in plus 2ft 6½in plus t 5in, an overall length of 7ft 6in, two sections each 3ft 9in long.

ASIC RESONANCE

Further calculation indicates that a pole having these dimensions has a ndamental resonance at 62.5Mc, ıich is on the fringe of Channel 2. would also be close enough to Chan-l 1 to ensure reasonable signal pickup.

So much for element length.

The next step is to achieve a broader sponse around the natural frequencies resonance by such fundamental easures as using a lded dipole, or rge diameter bing or making e dipole elements om large flat etal strips, giving e appearance of over-size bow-tie.

The fan aerial nulates this last ethod by using o or more rods r each half of the ole in a narrow fan formation.

by W. N. Williams

The effects of using different numbers rods and different fan angles is not dily calculable, but custom is to make fan-angle between the outer rods out 40 degrees.

ESSENTIAL AERIAL DIMENSIONS

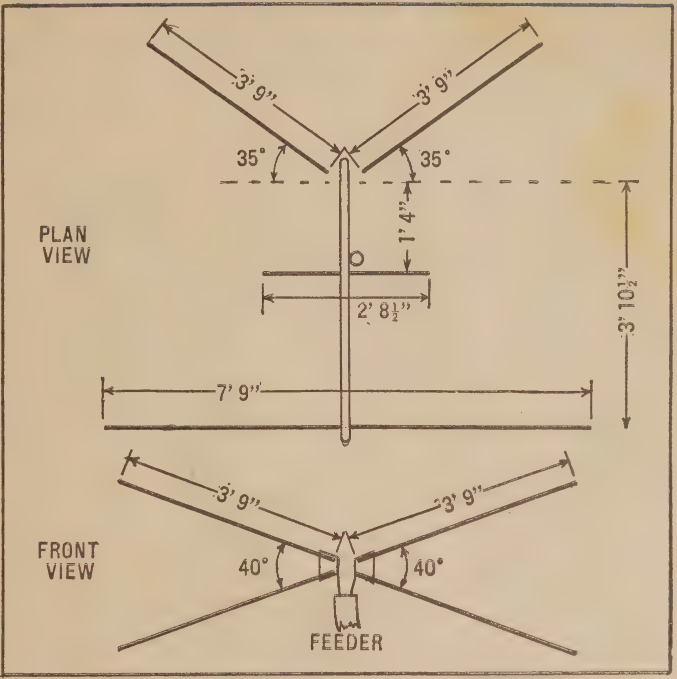

Figure 10: This diagram shows all the essential measurements of the fan aerial. The two reflectors can attach directly to the metal boom but the two sections of the active dipole must be insulated one from the other and from the boom.

Some commercial fan aerials use only the two outer rods. Some use a third centre rod of similar length, while others use a centre rod cut for fundamental resonance adjacent to the high channels.

Our own observations suggest that the centre rods in any form have only a very secondary effect, and can be omitted, if desired, in the interests of economy, simplicity and weight.

But that is not the end of the story. As explained last month, a simple dipole at its fundamental resonance has a sensitivity pattern (polar diagram) rather like a figure 8, maximum signal pickup being broadside to the element.

This observation would hold for the fan-style dipole already suggested for frequencies around 62Mc.

At 193Mc, however, where the aerial is virtually three half-waves in series, the signal pickup pattern becomes quite complex, with four major side-lobes inclined at 40 degrees from the element and only minor lobes in the broadside direction.

This would constitute a serious directivity problem because, with the aerial orientated for maximum response from the transmitting site on Channel 2, pickup on the high channels would depend on only one minor lobe. The aerial could offer little discrimination against "ghosts" or interference from other directions, because of all the remaining lobes.

The effect is countered in the fan aerial by inclining the active elements forward. This causes the three frontal lobes to merge without greatly affecting the pattern of the aerial on the low channels.

LIKE "V" BEAM

Actually, for the higher channels, the aerial begins to take on the characteristics of a "V" beam. The forward tilt angle is normally made about 35 degrees, giving an included angle of 110 degrees — a figure suggested by published design data on "V" beams.

Directivity is thus obtained on the high channels largely by reason of the forward tilt. However, it can be augmented, if desired, by mounting a reflector behind the apex of the flare. A reflector effective for Channel 7 and still partially operative for Channel 9 could be 2ft 8½in long and spaced 1ft 4in from the apex of the active elements.

Directivity on the low channels requires the use of a conventional reflector. If it is to be fully effective for Channel

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However, if your dealer cannot supply do not hesitate to contact your State distributor direct.

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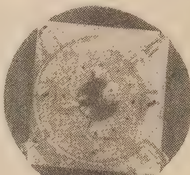
MELBOURNE: H. M. Sampford, 99 Bridge Rd., Richmond, Vic.
ADELAIDE: L. S. Wise. PERTH: Athol M. Hill.

SMITH ENGLISH PRESET CLOCK



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- Sweep second hand.
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M.32 is a 32 ranged 1000 O/V Radio-Elec. service Multimeter. DC Current to 10 Amp AC Current to 1 mA. (for use with ext. CT.) Ohms to 10 megohms.

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THYRON RADIO SUPPLIES

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'Phone WX3428.

it must have a length of 492/63 feet, uals 7ft 9in.

Spacing would be one-quarter wave or t 10½in from the apex of the active ements.

It is obvious that such a reflector would t as a director for signals on Channel giving the aerial better pickup from e rear than from the front. This actuly occurs in many commercial aerials, it is ignored, partly because Channel 1 not in use at the moment, and partly cause signals from Channel 1 should esent the least worries in terms of sigl strength.

The position could be altered by ineasing the reflector length to 10 feet, ough with some loss of directive qualies on the higher channels.

UITABLE DIMENSIONS

Dimensions of a fan aerial, based on e foregoing discussion and suitable for nannels 2, 7 and 9, are given in figure).

Fan aerials are normally used with 0-ohm feed-line. There is a considerble mismatch on the low frequency annels but usually not enough to predice reception.

Matching on the high channels is genally conceded to be good, because of e harmonic operation of the aerial. Adjacent to channels 4 and 5, where e aerial looks like two half-waves, the anding wave ratio on the feed-line ay be considerable. However, overas reports indicate that quite good sults are nevertheless obtained, parularly if the feed-line length is pruned refully to suit these channels.

When it comes to constructing an rial system to the foregoing specificaons, there is room for individuals to ercise any amount of ingenuity, both choice of materials and in methods mounting and assembly.

One point must be stressed, however. Television aerials are subject to approval by local councils and building inspectors may refuse to pass structures which are unsightly, inherently weak or insecurely mounted. If you are not prepared to make a good job of the aerial, don't start.

Commercial aerial systems are invarily built from hard aluminium alloys, the grounds of lightness, strength d resistance to prolonged corrosion.

Home constructors can follow suit, if y so desire, since suitable tubing can bought from merchants dealing in minium and alloys. For the elements, line of about 3-16in diameter alloy l looks particularly attractive.

ECHANICAL JOINTS

The big difficulty with aluminium is fact that it cannot be soldered by linary means, so that all joints must purely mechanical—threads, nuts. ets, clamps, etc.

This may present something of a probn to the home constructor, added to ich there is always the chance that h joints will deteriorate electrically er exposure to the elements.

Distinct from aluminium, home conuctors could well consider some of thin-walled steel tubes which are ilable ex-disposals and originally inded for mobile radio "whip" aerials. is tubing is light, very strong and is pper-plated beneath the coat of paint. can be locked and sweated in position, then readily painted and sealed against corrosion.

CLOSE-UP OF ELEMENT SUPPORT

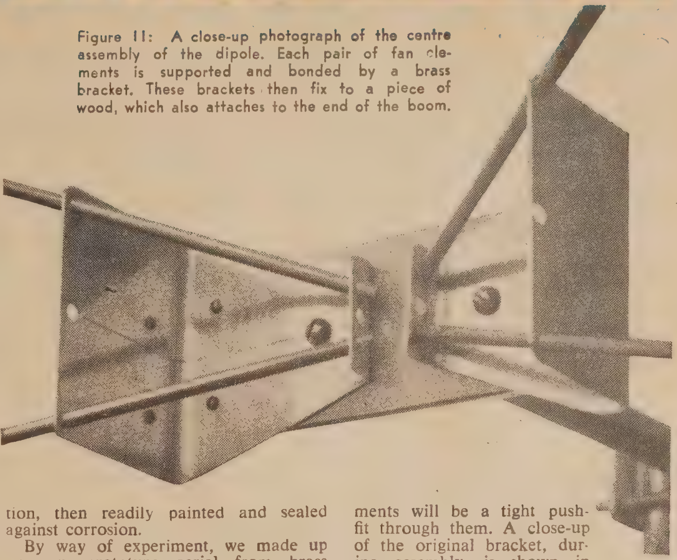

Figure 11: A close-up photograph of the centre assembly of the dipole. Each pair of fan elements is supported and bonded by a brass bracket. These brackets then fix to a piece of wood, which also attaches to the end of the boom.

By way of experiment, we made up our own prototype aerial from brass plate and tubing, bought in the ordinary way from a city warehouse. The drawings and photographs show how the original was made. You can follow them in detail or devise a method of your own, provided the result is the same electrically.

First job is to make a couple of brass brackets for the centre of the dipole, to the dimensions shown in figure 12. The three centre holes are for mounting purposes, while the two (or three) along the edges are to hold the dipole elements.

After the brackets are bent to shape, these latter holes should be distorted with a file or drill so that the aerial elements will be a tight push-fit through them. A close-up of the original bracket, during assembly, is shown in figure 11.

If desired, the dipole elements can be complete lengths of ¼-inch tubing. However, tapered elements look better and are lighter.

For the prototype aerial we made up tapered elements from 2ft lengths of ¼in tubing, into which we inserted equal lengths of 3-16in tubing.

GOOD FIT

By slightly crimping the larger tube, a tight push-fit results. Clean the surface of the smaller tube, heat and tin the surface as you telescope the two, and it is easy to make a secure internal sweated joint some 2in long.

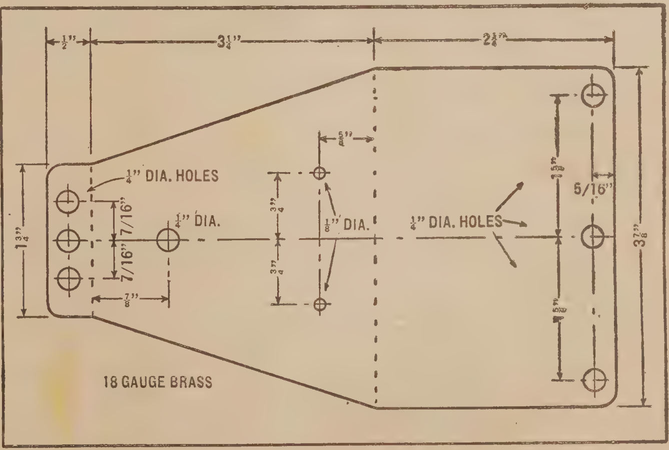

Figure 12: Use this diagram to mark out the brass brackets pictured above. The centre elements in the fans can be regarded as optional and the brackets can therefore be cut away at the centre if desired to reduce their bulk.

For Xmas and 1957

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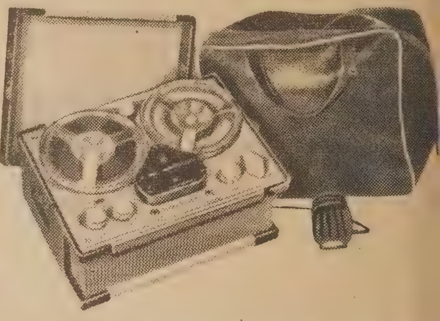

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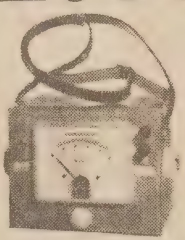
T.V.



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....

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ADDRESS ....

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I enclose LARGE self-addressed envelope and 6d in stamps.

The elements are then trimmed to the ight overall length and the remote end lo-ked with a small brass wood screw nd a rounded blob of solder. Polish vith Brasso, and you will have a very rofessional-looking piece of metal.

When the aerial is ready for final as-embly, the elements can be inserted in heir respective holding brackets and ecurely sweated in position. You may are to push a pin through the inner nds, which can be sweated over, just o make sure that elements cannot come drift if the solder should fracture.

In the original aerial, we passed a ength of heavy copper wire (about 2-gauge) through the inner ends of the lements, bringing the ends down and orming an eyelet for easy connection o the feedline.

It is essential for the two halves of he dipole to be insulated from one nother and from the boom. Commercial erials use mouldings for the purpose, ut this is out of the question for a ome builder.

We suggest that you select a scrap of vell-seasoned wood, hard and close-rained, and make up a support along ne general lines indicated in figure 13. Ve used two thicknesses glued together, ut the exact shape is not critical.

A good auger bit or centre bit is ssential to drill the hole at the back to eceive the end of the boom. The hole hould be drilled nearly through the lock—but not quite. It should have arallel sides and be a very tight push-t for the boom. If it isn't, the dipole ssembly will be sloppy and insecure.

Drill holes to take the dipole brackets, nen fill and paint the wooden block to ender it weatherproof, not forgetting ne hole for the boom.

When dry, the inside of the hole can e moistened again with paint and the oom driven into place. A long 1-8in r 3-16in bolt can then be passed rough the block and the end of the oom for added security.

Next step is to make up (or buy) a ouple of U-bolts to attach the boom whatever mast is chosen. The U-bolts the original were bent up from a few ches of ¼in brass rod, using hammer, vise and a scrap of steel tube to give the right radius. (The ends were threaded ¼in Whitworth before the bend was complete.)

We used a length of 7-8in diameter brass tube for the boom and for the top section of the mast—hence the dimensions given in figure 15. If your boom or mast is of larger diameter, the U-bolts will have to be amended accordingly.

The ends of the U-bolts pass through a plate, drilled to suit, and made, in our case, from a double thickness of 18-gauge brass. A small V-channel, riveted and sweated against the inner surface, prevents the block plate from twisting.

If you can find the necessary metal, a better idea would be to make up the clamp from a single heavy brass block with a V-groove filed down the centre Alternatively, a search through hardware stores may bring to light suitable fittings, ready made.

FEEDER CONNECTION

A socket to go between the boom and mast could likewise be purchased, filed from a solid block or made up from two scraps of the same tubing as used for the boom. Another scrap can be used to reinforce the boom where the U-bolts pass around it.

Having finished and fitted the clamp, the two reflector elements can be attached to the boom. You can use clamps

(Continued on Page 123)

SUGGESTED SHAPE FOR WOOD BLOCK

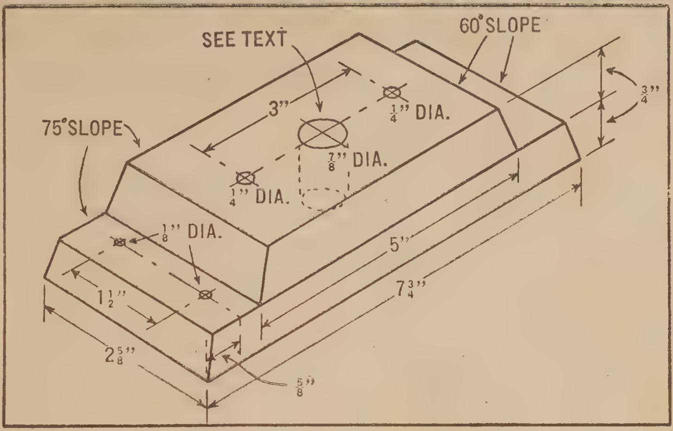

Figure 13: A suggested shape and size for the wooden block which supports the two dipole sections. The wood must be hard and well protected against sun and moisture.

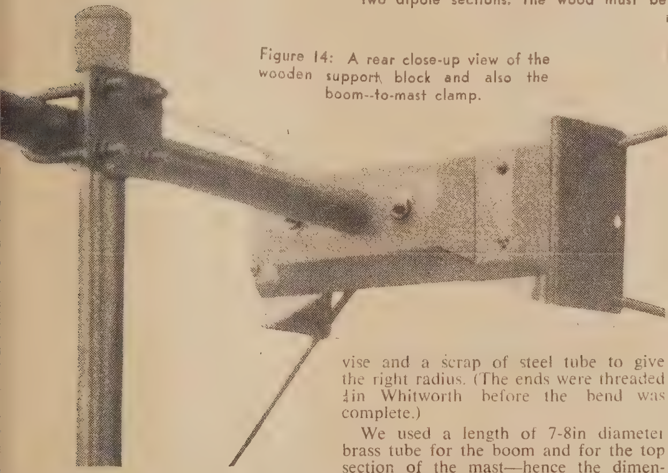

Figure 14: A rear close-up view of the wooden support block and also the boom--to-mast clamp.

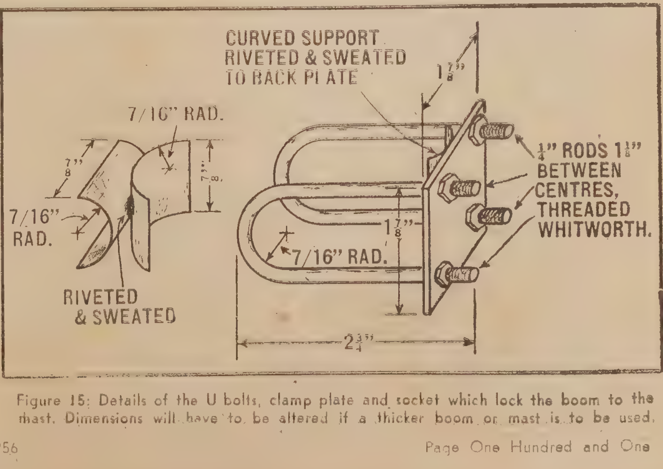
CURVED SUPPORT RIVETED & SWEATED TO BACK PLATE
1⅞"
7/16" RAD.
⅞"
⅞"
7/16" RAD.
¼" RODS 1⅛" BETWEEN CENTRES, THREADED WHITWORTH.
1⅞"
7/16" RAD.
RIVETED & SWEATED
2¾"

Figure 15: Details of the U bolts, clamp plate and socket which lock the boom to the mast. Dimensions will have to be altered if a thicker boom or mast is to be used.

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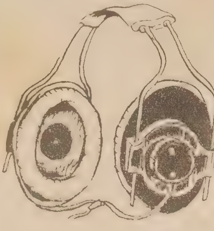

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12SR7	12/6 ea.
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6AJ5	12/6 ea.
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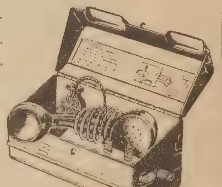

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OFF THE RECORD — NEWS & REVIEWS

Will there be any future for the 16 2/3 rpm speed for standard record consumption? That is a question which many people are asking themselves as we hear more about discs made for this standard, which has been used in special cases for some time.

by John Moyle

O date, these special cases have been confined in the main to talking re- rds in which speech only is concern- . In the USA quite a few of these ve been produced, records of speeches famous people, life-stories of pro- inent personalities, records for teach- g purposes, and so on.

Few if any have laid any stress on usic.

The exception to this—and it is the ost significant as far as speculation is ncerned—are the discs specially made Columbia for the Chrysler Motor rporation, and intended to be play- on the gramophone units fitted to se cars so that the owner can have usic other than that provided by the dio.

LTERNATIVE TO RADIO

Why anyone should wish to do this 't very clear, unless it is simply that gadget-minded Americans don't like be confined to predetermined broad- st programs if they can buy something ich will give them a choice.

It is possible, too, that in the long tor runs which are quite common the States, radio reception isn't always od enough for first-class entertain- nt. And if it is, the universal radio vertising no doubt gets on the nerves those who like to have good music ile they eat up the miles.

The catch at the moment is that these ords can't be played on anything ex- t the units provided in cars. The ed isn't the barrier, for there are ite a few turn-tables now which in- de 16 2/3 rpm in their repertoire.

But the discs themselves are cut with oves only half the diameter of the sent microgrooves, and can only be yed with a stylus having a point dia- ter of .5 mill.

UALITY LIMIT

Without going too deeply into the thematics of the matter, which are general familiar to those interested records, it is not possible to equal the ality of present LP's at half speed hout considerably increasing the nimum diameter of the discs them- ves. This would largely defeat the ject of the slow speed, which would to give more music per side.

Undoubtedly the car records do this, can quite conveniently compress a ole symphony on one side of a 7-inch ord.

One would imagine it impossible to p such a tiny point in its grooves ile rushing along the highway, but clever design it has been done. Un- tunately I wasn't able to locate one these extraordinary devices during recent trip, although I did bring k some of the discs, none of which have yet been able to play through k of a suitable pickup!

t is rather risky these days to be too dogmatic about what might be done, but for the moment it doesn't seem that we will see these records on general sale in the foreseeable future.

The main reason I think will be that, although the public has now become used to three speeds (which are rapidly becoming two only), they aren't nearly so happy about having to use two types of stylus to play them. Once having progressed to the point where the 78 stylus can be ignored, and overseas this is becoming nearer the truth every day, they are unlikely to welcome the introduction of a third.

STYLUS POINTS

Nor will makers of pickups find it easy to provide three different points to their pickup mechanisms, particularly as the job of producing the extremely fine tip in any quantity would be difficult and expensive.

The processing of discs, too, would buy into many headaches for record manufacturers, who are finding it hard enough to preserve real quality with those they must make at the present time.

It is doubtful, whether the advantages of the slow speed are nearly as great in proportion as those donated to us by the jump to LP's. No one really minds a break every half-hour or so to change a side—in many cases the pause is welcome. The only major advantage, presuming that quality can be maintained, is that the disc itself can be smaller and cheaper.

I spoke to executives of the Columbia record company in New York about this matter, and they expressed no interest in pushing their new record beyond its original purpose.

PUBLIC DEMAND

Naturally public demand will always prevail, and if this should exert sufficient pressure, there is little doubt that Columbia and others would be in it. But I was told that, for the moment at least, there was no intention of trying to force the pace. It might even be that the whole thing will get no further than a luxury fad stage, and die a natural death.

Meanwhile I am itching to grab a slow-speed motor, rustle up a fine point from somewhere, and find out just how good the present records are!

NEW RECORDS

BEETHOVEN—Sonata No. 9 in A Major Opus 47 (Kreutzer). Played by Gioconda de Vito (violin) and Tito Aprea (piano). HMV OALP 1319.

Don't let the lesser familiarity of the soloists fool you, or the fact that the violinist is a woman in a world of so many fine male performers.

Gioconda de Vito, who is well known in Europe, handles the bow with firmness and strength. Her intonation is faultless and her approach free from any caprice. It is a classical performance, if not a very deep one.

LIGHT TOUCH

In fact the second movement is played with a light, almost delicate touch, which at times becomes semi-audible.

This might not bring approval from the pedants, but at least it keeps those pizzicato notes in reasonable sonic proportion. So often they are merely anaemic and ineffectual noises. There is some finely shaped playing in this movement.

The pianist, whose balance with the violinist is so vital in this sonata, and whose part is equally important, is well

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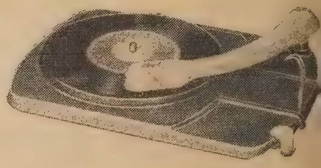

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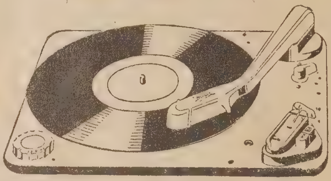

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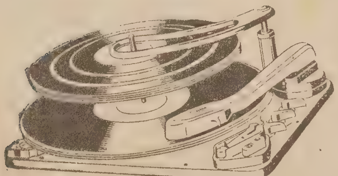

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osen. Both are recorded with a nd, full tone.

thought they could have given the t movement with greater weight and or—here the music seems to have nned out more than it should.

But it is possibly the best all-round sion at the present time—technic y fine with no surface noise to speak Use the RIAA curve.

SALZBURG AND MOZART.—Special record with programme notes and musical illustrations chosen by Bernhard Paumgartner. Philips SO5906R.

Everyone should like this disc—in its y it is unique.

t contains 25 extracts and fragments m Mozart's compositions, ranging m a suitably juvenile performance of first minuet and trio for pianos (is a Mozartpiano or has some careful erdemain been at work?) to the 427 Mass.

They are all linked together with a mentary—rather fulsome in parts— Bernhard Paumgartner, most of ich is intelligent and interesting if e of the words are difficult to catch.

NE PLAYING

t is inevitable that the extracts should tantalisingly short, the more so bese they are all beautifully played and ally beautifully recorded.

liked particularly the atmospheric ches such as the bells of Salzburg, typical of the many-toned sounds I e heard in European towns at sun-

The recording amplitude of the commtator's voice is, in general, higher n that of the music, which is rather tly cut. The surface is quite noise-

Those who are tolerably well uainted with Mozart's music may want to play this record very often, as a "youth concert" I cannot praise oo highly.

Thanks to Philips for a delightful disc. st of Mozart's best is here.

MOZART—Symphony No. 36 in Major, KV425. Symphony No. 3 in B Flat Major, KV319. Played by the Bavarian Radio Symphony Orchestra, conducted by Eugen ochum. DGG 18228, LPM.

My only serious critical comment on disc is that it lacks in range at both s.

The music will almost certainly be yed at moderate level, and I liked it with appreciable bass boost and the ginal Decca curve.

Under these conditions it is altogether ghtful. The orchestra is just the right , and the reverberation has been nged for liveliness and clear instrutal definition.

PPY MOOD

Both these symphonies were the prots of Mozart's happiness—they hold type of joyfulness in which there is hint of tension or complication of ght.

Both performances blend a light touch flexibility and sensitivity, and have ecision which is never machine made. is anything slurred or overlooked s the kind of playing you can hear pleasure many times.

A most rewarding disc.

CURZON GOOD IN BRAHMS NO 2

BRAHMS—Piano Concerto No. 1 in D Minor, Opus 15. Played by Clifford Curzon and the Concertgebouw Orchestra of Amsterdam, conducted by Eduard van Beinum. Decca LXTA2825.

This isn't yet the ideal performance I have been looking for. but it is well up in the preferred list among the half-dozen versions I now have for comparison.

The fact that my favorites were released about three years ago may be a significant comment on the difficulty of the work from a recording point of view. Not yet have the right pianist, orchestra, conductor and recording conditions come together at the right time.

Whether anyone has really succeeded in coping with those enormous octaves at the opening and closing passages of the first movement, and at the same time managed the gentle serenity of the second, might well be argued, if we except Schnabel, and perhaps Backhaus in his prime.

Solomon's performance with the Vienna Philharmonic, which I heard in London recently, came very close to it, but he was playing to an audience and not to a microphone.

LIGHT ON POWER

Curzon hasn't quite the power and full tone to supply the weight required by those big passages, although the recording has helped him to build it up.

He is much better in the quieter, reflective moods, despite his irritating habit of crawling into a shell from which he produces a very tiny sound, as though he begrudged you an audience at all.

Despite this, his performance is understanding, scholarly and well shaped. It is impossible to dislike any of it.

There is a remoteness about the sound, not so much of distance as in lack of sharp outline. Orchestral definition is frequently poorer than in many present-day discs—one hears the sound without being able to detect precisely who or what is playing.

Frequently the piano is lost in the ensemble, but a certain amount of fusion isn't out of place with this music. Closer miking would have been highly dangerous.

The orchestra I think is better than in any contemporary. and that goes for its recording. The strings have some lovely moments—there is always warmth and well proportioned phrasing.

Van Beinum isn't a showman. but then neither is Curzon, which may account for their undoubted ability to see eye to eye.

PLAYBACK CURVE

I found difficulty in picking the best playback curve. Finally, I used the old Decca with some bass boost, but the RIAA will do quite well, although the danger is that the sound will be a little dull. The surface is satisfactory, although not perfect. It is well cut, the piano particularly suffering no distortions or poor tone quality.

I doubt whether the performance is the equal of the Backhaus record of about the same vintage, but the sound is better, and in the absence of any musical violence, I think I must prefer it.

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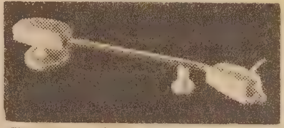

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BEETHOVEN—Violin Concerto in D major, Opus 61. Played by Wolfgang Schneiderhan and the Berlin Philharmonic Orchestra conducted by Paul van Kempen. DGG 18099 LPM.

If you want the best recording of the ethoven currently available you might ll select this disc. Your choice would obably lie between this record and at of Oistrakh.

Personally, I think I would choose s one as coming closer than any to / idea of how it should be done. It is fact, one of the best performances have ever heard.

Every violinist of note plays this conrto, and I fear it is beyond quite a v of them.

Schneiderhan plays it in the classical adition, searching for the music witht compromise. He does not project rtuosity where it is not wanted, he does t bury the second movement in an gy of lush sound, nor does he rush e last in an unmeaningful scramble.

He is not the technical equal of Oisakh, nor does he approach that nearrfection which is often a subtle barrier complete success.

OOD PROPORTION

He shapes the music in fine proportion, cking a little in strength, maybe, but ways with a true ear and broad manity.

A more vigorous treatment of the last ovement would have been welcome. me vitality seems to have been traded r careful balance in the contrasting ctions which are handled so admirably

As with most DGG discs, it has a ar-concert-hall atmosphere. Soloist and chestra are in full sympathy — they end well musically and sonically—one the record's best features.

I would say that, no matter how your eference will lie, with Milstein, Stern, enuhin or even Elman, you will find is version featuring in your decision r many moons to come.

TCHAIKOWSKY — Symphony No. 6 in B Minor, Opus 74 (Pathetique) played by the Berlin Philharmonic Orchestra, conducted by Ferenc Fricsay. DGG 18104 LPM.

The Pathetique, I think, is Tchaikowy's best symphony, and one of the ost popular ever written.

In general terms I liked the way in ich this conductor and orchestra have aped it. Every phrase is made to unt — no detail is thrown away, or ls to be heard.

This is a work whose strongly emonal content must be blocked out in vance. Otherwise the conductor will d himself with several anti-climaxes his hands, and lose altogether the isic's cohesion and force.

ISK PACE

The pace throughout is quite brisk. e third brought the only hint of atchy playing, if one can so reprove s fine orchestra.

Recording is on the remote side by odern standards. Occasionally the rerberation time of the hall can be clearestimated, and I think this has dulled mewhat the impact of several highhts. The opening bars of the last movement sound almost tame after the exhilaration of the third, as though there has been some inaccuracy in judgment at the level controls.

Dynamic range is adequate, but could have been increased with some advantage, as also could the extreme top response. For there is an urgency in the performance which might have registered more satisfactorily in the hall than it has done on the tape.

There is plenty of weight, ample bass and a dead quiet surface. If this recording is not as spectacular as some, it is musically very satisfying.

The RIAA curve sounds good.

RIMSKY-KORSAKOV — Scheherezade Symphonic Suite, Opus 35. Played by L'Orchestre de la Societe des Concerts du Conservatoire de Paris. Decca LXTA5082.

As a replacement for the early Decca disc, this one brings Ansermet thoroughly up to date.

To play the two on a comparative basis merely serves to show how far we have come since the 1950s.

The new version has a clarity, impact and quiet background unequalled or matched by its predecessor.

The composer intended this music to scintillate. Ansermet and the orchestra have done just this, particularly in the final section, with great realism.

I think Decca have been wise to abandon the emphasised top end which was characteristic of their early efforts, and which, at best, was rather hard to handle. There is no trace of it here. The RIAA curve produces vivid and brilliant sound, full in body and with no urge to experiment with the top-cut control.

This is certain to be a popular release.

DVORAK—Cello Concerto in B minor Opus 104. Played by Paul Tortelier and the Philharmonia Orchestra conducted by Sir Malcolm Sargent. HMV OALP 1306.

One advantage of recording a cello concerto is that, in contrast to a concert hall performance, we can always hear the cello.

In fact we generally hear it larger than life, because it is by no means a powerful instrument when balanced in solo form against a full orchestra.

It would be quite impossible to achieve anything like the same prominence as has been obtained, for instance, in this superb piece of recording.

There are some fine versions released in the past, but this is the only one which has led me to forsake my erstwhile favorite—that by Janigro on a Westminster of a few years ago.

Even now the victorious margin is small.

FULL TONE

Tortelier, as does Janigro, produces his full tone with obvious ease and with complete accuracy. He may lack the full air of authority which Janigro manages to establish and preserve, but there is more romantic warmth to him— exactly the right amount, for this isn't music to drool over.

Only in one notoriously difficult spot in the first movement can he really be faulted. One doesn't feel inclined to be niggly about such beautiful playing.

The orchestra and Sargent have avoided any emotional complexities, and rightly so, for it is a mistake to dis-

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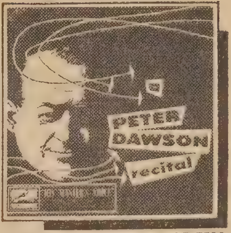

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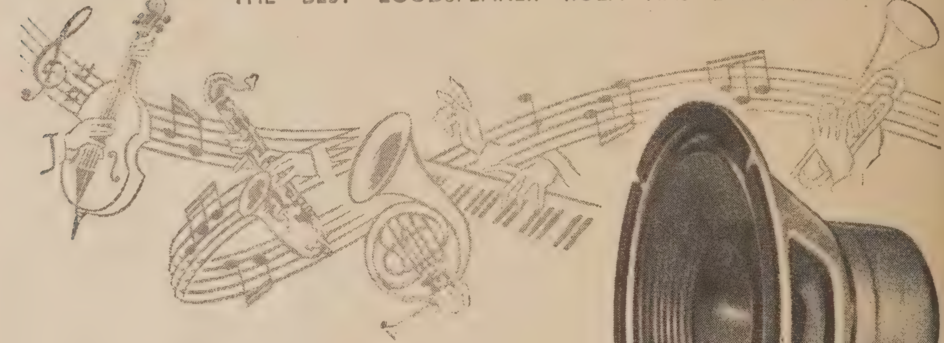

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b too deeply the surface of this ely work.

Technically the disc is fine, with rcely a flaw from start to finish. Some the more forward cello passages are od enough for demonstration work. s definitely a "recorded performance" nothing concert hall about it. The face is first-class.

t will be a long while before we get better version.

Jse the RIAA curve.

* * *

SAMUEL BARBER—"Souvenirs" Ballet Suite. SHOSTAKOVITCH —"The Golden Age" Ballet Suite. Played by the Philharmonia Orch-estra conducted by Efrem Kurtz. HMV. OBLP 1080.

According to the jacket note, Bar- 's suite, originally meant for one no and four hands, has its scenario the Hotel Plaza in New York, the r 1914. The music, we are told, was nceived in nostalgia "without a trace parody".

This may be so, but you will soon ect an English atmosphere about the rk, with more than a trace of the od found in Walton's Facade.

I wonder whether it was this which mpted the remark quoted above.

f you like this clever, competent but onsequential treatment, you'll cer- nly enjoy a performance which is ely and clean-cut. But even if you see it no parody, you may feel inclined settle for a good-natured cartoon.

The same jacket notes tell us that Golden Age of Shostakovitch is a ire on a capitalistic city, full of ely wit and rude noises. The Polka alleged to describe a peace con- ence at Geneva.

We might find it hard to fully appre- te the "party line", but not the mor of the musical comment, rude ses and all. Some of the material bound to be familiar.

The recording is excellent, but I ldn't help wishing for a little more of sharp edge which Mercury, for in- nce, would have given it. That would ve created quite a show piece.

There is no surface noise. Use the AA curve with perhaps a notch of s boost as an improvement.

* * *

SIBELIUS — Symphony No. 1 n E minor. Played by the Phil-harmonia Orchestra, conducted by Paul Kletzki. Columbia 330CX 1311.

t is quite amazing how differently well-known conductors can see a re which, presumably, looks the same paper.

Take the opening bars of the third vement of this symphony. There is a id phrase for the tympani which, to is a key point in the whole thing. tzki thinks so too, for he plays it most prominently.

n a recording by Anthony Collins, same passage is given out in a man- one can only describe as explosive. But Beecham, who has also recorded symphony with the Royal Philhar- nic, is so little impressed with the that you must listen quite carefully hear the drum at all.

s a matter of fact, this is a pointer he main difference between the Bee- m and the Kletzki. The latter is much e enterprising in his approach, although not as dramatic as Collins, who plays on a degree of tension not reached by any other version.

This one probably comes as near to the average of them all as most people will like, and I can recommend it on those grounds.

In fact, I can recommend any of the versions in their own way, for all music lovers should have one or the other in their libraries. The recording on this one is not really surpassed by any of its contemporaries although the Collins has a greater impact. There are few symphonies which have been so well served by current recordings.

* * *

DEEMS TAYLOR—Through the Looking Glass, Five Pictures from Lewis Carroll, Opus 12. Played by the Eastman Rochester Symphony Orchestra conducted by Howard Hanson. Mercury MG40008.

Deems Taylor is one of America's best known musicologists, writers and commentators, but as this record reminds us, he is also a composer, a fact which I had overlooked to date.

In fact, the jacket notes tell us that this work is a classic of the American repertoire, and a flawlessly acomplished work of art.

I am very glad to know that, and also to find that, as the jacket also points out, there is parody and scholarly wit in parts in which I wondered whether the comcomposer had run out of inspiration or had intended it that way.

Musically it is diverting enough, and not hard to listen to, particularly as there is quite exciting recording to hold your attention when the music does not.

In fact I thought it more successful as a competent display of what an orchestra can do in a "Grand Canyony" kind of way than as a program piece about Alice in Wonderland.

Undoubtedly the emphasis is on instrumental effects, colorful climax, and rather showy texture in which a bright band of players can revel.

This one is extremely bright, and Mercury has done a most impressive job of the sound. It is a trifle edgy, but its precision, vivid lines and well balanced, full frequency range will delight the hi-fi enthusiast.

The jacket notes warn you to look out for some of the best bits, chief of which is a descending scale involving the bassoon and contra-bassoon running through the full instrumental scale.

It all comes through from a clear, quiet background which makes the best of a very wide dynamic range, not forgetting some effective work from the basses.

Some of the themes will remind you of all kinds of things—the opening bars are almost identical with a piece for orchestra and piano by Lindley Evans. I wonder who came first?

I give it top marks for recording and, after all, I suppose it is amusing enough.

* * *

TCHAIKOWSKY—Serenade for Strings. SMETANA — Bartered Bride Overture. RAVEL—Bolero. Played by the Philharmonia Orchestra, conducted by Paul Kletzki. Columbia 33CX 1164.

Any good conductor with a good orchestra can make fine music with the Serenade, and so it happens here.

At the same time, I am a bit disappointed it doesn't sound rather better.

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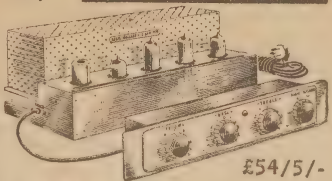

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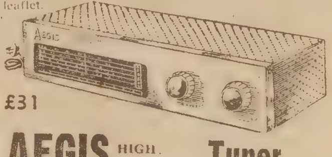

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The orchestra isn't always at its top Philharmonia standards. I ught the opening bars, for example, ked decision. They are extremely im-tant bars; they give a key to the ole work in context and in mood.

Maybe the players were a bit tired. could be that this piece was recorded r the end of a session, for it isn't al to hear this orchestra anything less n perfect with entries of this type. re they make their attack anything cleanly.

Microphone placing could have been ser with benefit, otherwise the record- is good—typical of the current Phil-monia standard, and most probably de in the Kingsway Hall.

The Bolero is there to the last drop, both orchestra and audience. I was ficiently intrigued by the fine display the various instruments as the mad-ning tune worked its way through m all, to play it right through.

Interesting, too, to note the acoustics the recording hall in an example not en met with in musical scores.

If the climax lacks some dash, it isn't nus any weight. The Bartered Bride kes a good fill-in. There were a few atchy sounds on one side of my disc, erwise, the surface is 100 pc.

* * *

MOZART—Concerto in A major K488; Concerto in C minor K491. Played by Solomon and the Philhar-monia Orchestra conducted by Herbert Menges. HMV OALP 1318.

Above all things, Solomon loves to y in a quiet, reflective mood. He is of the finest pianists alive in this— d he knows it. It isn't easy to main-n a slow tempo without losing either own track or the attention of his eners.

He has plenty of practice on this disc he adagio of K488, for instance.

There is no doubt at all that his pace the result of design, and carefully culated design at that. He is always iberate and completely controlled, n when slow almost to the extreme.

On the other hand, despite his beauti- air of relaxation, I felt he carried too much into the brighter moments both concertos.

As a result, the music is sketched on small a scale.

After all, allegro and allegretto are re than just indications of pace — y call for a brightness of mood which lomon doesn't quite achieve.

It's probably a matter of taste, and I uld not discount either fine perform-e because of mine.

The orchestra is good, but it, too, is t in weight. Some bass boost won't any harm, or tend to spoil the bal-e. It's a record charming and taste- rather than impressive.

A faint rustle of surface noise isn't ely to bother you.

* * *

THE HARP IN HIGH FIDEL-TY—The Harmonious Blacksmith (Handel), Giga (Corelli), Scintilla-tion, Ballade, Menuet d'Amour Massenet), Petit Valse, La Desirade, Traipsin' Thru Arkansaw. Played by Carlos Salzedo. Mercury MG80003.

Not being an expert on the harp as musical instrument, I can only say t there doesn't seem to be much Sal-lo doesn't know about it.

All the items have been arranged by him, and many are his own compositions. He lives up to the claim to imitate at times the xylophone, tam-tam, tympani, whistle, and eolian flux, to omit many others.

The recording is very good, and doesn't miss a thing. There are consequently a few mechanical noises which will puzzle anyone ignorant of the mechanism of the instrument, and the player's zest produces some twangy sounds when full pressure is applied.

It is a jolly good thing to see something being done to make available records like this, which give music lovers a chance to learn something of the potentialities hidden in instruments rarely heard by themselves.

And without doubt, Salzedo, one of the most famous harpists alive, does just that on this disc.

* * *

STUDENT PRINCE AND OTHER SONGS — Mario Lanza with orchestra directed by Constantine Callincos. RCA L16039.

You really have to be a Lanza fan to take in this record, but if you are you will love it, for it has more of him in the one place than you are ever likely to hear again, including practically all his hottest hits.

Judged as a work of art I can't rate it highly, for Lanza does just about everything a singer isn't supposed to do.

He doesn't really sing at all, he emotes on a single key, he treats all comers with the same assurance and technique, and always appears under great mental and physical duress as he does so.

Rarely have the emotions been presented with equal lack of inhibition.

He is listed as a forceful and virile vocalist; virile he is not, for he is never so good as when competing for your sympathy and your tears.

Maybe that's why he has been so popular with the ladies.

The engineering is quite good,, save for a preponderance of lip noises and explosive sibilants is many songs.

To sum up—good, but strictly for addicts.

* * *

SAX IN SILK — by Bobby Dukoff with his tenor saxophone, orchestra, and the Ray Charles Chorus. RCA L10098.

As an example of the new Orthophonic high fidelity, backed by all the resources of mike technique, echo chambers, vocal backgrounds—the lot —this record succeeds completely in what it sets out to do.

There are a dozen popular numbers, mostly in slow, "moody" time, slickly and competently done in a corny kind of a way, but very easy to listen to if you like it.

Using a new type of ultra-directional RCA mike, the saxophone has an ultra-ultra-presence which not only produces vivid realism, but you can also hear the breath noises even when the reed is almost silent.

Personally I'd like just a little less of this realism which makes me feel that the sax is blowing right down my aural orifice.

It also seems to peak up the sibilants of the occasional vocalists who help to create the mood.

With these reservations this is a most successful disc, well cut, and with a good surface. The RIAA curve is advised.

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A Merry Christmas and A Happy New Year

To you and those within your home
This Christmas Day may blessings come
And may good luck, good health, good cheer
Be guests of yours for all the year.

FROM

AMALGAMATED WIRELESS VALVE COMPANY LIMITED

SHORT-WAVE NOTES BY ART CUSHEN

ADIO FREE EUROPE USES 63 CHANNELS

adio Free Europe, in its short existence is now operating on 63
equencies on short wave, in its transmissions beamed to Eastern Europe.

DIO Free Europe is a private broad-
caster, and funds are supplied by contri-
ns in the United States. The station has
shortwave transmitters at Biblis, Ger-
, with powers from 10,000 to 50,000 watts,
a further 13 shortwave transmitters are
ed at Lisbon, Portugal, with powers of
0 to 100,000 watts. The stations are
casting in Polish, Czechoslovakian, Hun-
n, Bulgarian and Rumanian.

e station's mailing address is Radio Free
pe, 110th West 57th St., New York 19,
Verification is by a card, which is
, and has overprinted the well-known
ty Bell, and the slogan, "That this world.
God, shall have a new birth of Free-
. The interval signals are of the Czech
Slovak National Anthems played on a
e, while the announcement "Radio Free
pe ." is given frequently.

dio Free Europe is assigned the following
encies.

Metre Band—3960 Kc.
Metres—5960, 5970, 5985, 6015, 6020.
6105, 6130, 6150.
Metre Band—7105, 7140, 7145, 7155, 7165.
7180, 7192, 7245, 7286, 7295, 7300.
Metre Band—9505, 9595, 9605, 9655, 9695,
9725, 9750.
Metre Band—11725, 11735, 11745, 11755,
, 11775, 11815, 11830, 11855, 11885,
, 11915, 11940.

19 Metre Band—15115, 15145, 15170, 15185, 15195, 15215, 15265, 15355, 15365, 15420.

16 Metre Band—17725, 17735, 17840, 17855. 17885.

13 Metre Band—21665, 21720, 21745 Kc.

Radio Free Europe operates in the following schedule:—

TO CZECHOSLOVAKIA

Weekdays, 1.58 pm to 9.00 am, 9.25-9.45 am, on 49, 41, 31, 25 19 and 16 metre bands.

POLISH SERVICE

Weekdays, 1.55 pm-6.25 pm, 7.28-9.25 am, in the 41, 31, 25, 19 and 16 metre bands.

Sundays, 4.50 pm-9.25 am (Monday), in the 49, 41, 31, 25, 19 and 16 metre bands.

HUNGARIAN SERVICE

Weekdays, 2.58 pm-9.00 am, 9.45-10.15 am, in the 49, 41, 31, 25, 19 and 16 metre bands.

Sundays, 4.58 pm-9.00 am (Monday); 9.45-10.15 am, in the 49, 41, 31, 25, 19 and 16 metre bands.

BULGARIAN SERVICE

Weekdays and Sundays, 12.45 pm-1.45 pm, 3.00-4.00 am, 6.00 am-8.00 am; in the 41, 31, 25 and 19 metre bands.

RUMANIAN SERVICE

Weekdays and Sundays, 1.45-2.45 pm, 4.00-5.00 am, 5.00-6.00 am, in the 41, 31, 25 and 19 metre bands.

News is broadcast on the hour, every hour, in the Czech, Hungarian and Polish services.

Tokio Using 17795Kc

ANSMISSIONS from Tokio in the Over-
seas service of Radio Japan is now carried
a new frequency of 17795 Kc, with the
sign of JOA22.

is transmitter is used to Europe, and gen-
transmission times have not been changed
h the frequencies of several of the ser-
have been revised.

0-2.00am to Indochina, JOA4 (11705).
(15235).
5-3.15 am to India, JOA4 (11705), JOB3
).
0-4.30 am to Near East on JOA4 (11705),
(9675).
0-9.30 am to Eastern North America, on
0 (17825), JOB5 (15235).
30-11.00 am to Eastern North America on
(11705), JOB5 (15235).
0-2.30 pm to Western North America on
(11705), JOB5 (15235).
0-4.30 pm to Hawaii, on JOA20 (17825).
(15235).
5-5.45 pm to Europe, JOA22 (17795), JOB9
5).
0-7.00 pm to Australia and New Zealand,
OA20 (17825), JOB5 (15235).
5-8.15 pm to South America, on JOA4
5), JOB3 (9675).
0-9.30 pm to North China on JOA4 (11705)
JOB3 (9675).
0-10.30 p.m. to Central China on JOA4
5) and JOB3 (9675).
45-11.45 pm to Philippines on JOA20 (17825)
JOB9 (15225)
dnight-1.00 am to South China, on JOA4
5) and JOB5 (15235). Power of these
mitters is 100,000 watts

Swiss on 11 Metres

was not surprising to notice that the Swiss
Broadcasting Corporation at Berne are to
the 11 metre band in the service to Aus-
, and New Zealand. The frequency of
Kc is used in the 5.15-7.00 pm and the
7.45 pm transmission.

e new schedule is as follows: North Am-
, 11.30 am-1.15 pm on HER3 (6165), HER4
), HER5 (11865); North America, 2.15-
pm, HER4 (9535), HER5 (11865); South
a, 12.45-2.30 am on HER7 (1774), HER8
0); Eastern Australia and New Zealand,
7.00 pm, HER5 (11865), HER7 (17784), HER8
0), HER9 (25640); Western Australia, 7.00-
pm, HER5 (11865)), HER7 (17784), HER8
0), HER9 (25640); South East Asia, 10.45
2.30 am on HER6 (15305), HER7 (17784),
8 (21520); India and Pakistan, 12.45-2.30 am
HER5 (11865), HEI9 (21605); Middle East,
4.30 am, on HER5 (11865), HER7 (17720),
d Kingdom, 4.45-6.30 am, on HER5 (11865).
6 (15305).

Reception in W. Australia

SIGNALS from some of the lesser-heard stations in the Africa area are contained in a list of stations heard recently by Cyril Anderson, of Mount Hawthorne, WA.

The time difference between his position and the listeners of Eastern Australia and New Zealand would make the logging of these stations at least two hours earlier, but during the next African season, this information may result in new loggings for many of our readers.

Some of the recent loggings are Beyrouth (8036), 6.00-7.00 am; Forces Broadcasting Service—Benghazi (7220), heard to closing at 2.15 am; Salisbury (6018) has been noted at 2.00 am; Sudan on 5000 Kc. has been heard in English 2.00-2.30 am; Accra, Gold Coast (3377) has been heard to closing at 8.15 am; Sierra Leone (3316) heard at fair strength to sign off at 8.15 am; Abadjan (4945) is usually good to 8.30 am; Angola (4950), Emisora Official, Luanda, is fair here to 8.30 am; ELWA (4935), Monrovia, has been heard on Monday to 9.15 am. Mauritius verifies with a printed air letter, from a report on the transmissions on 15037 Kc, weak signals generally noted here at 1.30 pm.

Broadcasting the Games

THE introduction of two new transmitters for the present Games broadcasts will be found of interest to listeners, but one of these stations, VLY, will only operate for the above period. The new 50,00-watt VLD transmitter will be put into the regular schedule of Radio Australia in the New Year.

Swedish test transmissions to Australia for the Olympics have been heard by K. T. Dunham, of Sydney, who found best reception on 21690 Kc.

New Zealand Expedition

NEW ZEALAND, like most countries, will have an expedition in the Antarctic for the forthcoming International Geophisical Year, and Radio New Zealand, is to transmit a special session for this expedition. The broadcast will be weekly and released at 6.15 pm each Sunday. The transmission is expected to be carried on the present Radio New Zealand frequencies, in use at this time, 6080 and 9540 Kc. Special transmiting aerials are being erected at the transmitting site of Titahi Bay, the transmitting site near Wellington ,and the broadcast will commence on December 30. The transmission will be of 30 minutes' duration, and will include family interviews for the men. The BBC have for some time been beaming a transmission to the British expedition at the area south of South Georgia.

FLASHES FROM EVERYWHERE

FRENCH SOMALILAND is reported to have a new 100kw transmitter under construction. This station was formerly intended to be placed at Saigon for the former Radio France Asie transmissions, but as this station no longer exists, the transmitter will be installed near Djibouti. The station will use the slogan, "The Voice of France in Asia and Africa."

JAPAN'S Nippon Short Wave Broadcasting Company, the only SW commercial station in the country, is operating on a new schedule—7.00 am-1.15 am, on 3925 Kc, 6055 Kc, both with 10kw; 9.00 am-8.00 pm on 9595 Kc, also 10 Kw. The program in English is presented midnight-12.15 am, which included features for foreigners in Japan, this includes a news bulletin at 12.05 am.

The station recently moved to new studios, since July 1st, and the address is now Nippon Short Wave Broadcasting Company, 7-4 Tamachi Akasaki, Minato-Ku, Tokio.

FRENCH EQUATORIAL AFRICA is on the air over Radio AEF from 3.00-6.30 am on 3230 (1500w). 4795 (1500w); 5970 (3kw); 9964 (1500w); 15420 (1500w); also over 9625 Kc with 50 Kw during the period 3.00-3.55 am.

MALAYA'S transmissions on 9615 Kc, which we reported two months ago, were carried on this frequency as a test, according to a letter received from the station by Ron McEwan, Victoria. The English session which was heard on this frequency during the test is normally carried on 4820 Kc.

COLOGNE'S transmissions to the Far East have now been noted on 13 metres, the transmitter using the frequency of 21650 Kc. The transmission is broadcast 5.00-8.00 pm and has the opening announcements in English, as well as a short news bulletin in English at 6.00 pm. Signals are the best on 13 metres, the tw other frequencies, 17875 and 11795 Kc, bot have rather severe jamming on the near channels.

News on readers' activities should be sent tc Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are Australian Eastern Standard.

INDONESIAN stations have been reported by Arthur Harris, who has been hearing these stations on 7080 and 15070 Kc, both of these being new channels. The program on was heard on a Monday from 9.00 to 9.30 pm when the English lessons were broadcast, while on the 15070 Kc station the English lessons were broadcast at 7 p.m. on Saturdays. These programs appear to come from Djakarta, but no full identification of the station's location was heard.

SEOUL'S transmission, which we reported last issue on the new frequency of 3910 Kc, has been noted with the English language transmissions at one hour later, and the session is now broadcast from 8.30 to 8.45 pm. The session is still being relayed on 2510 and 7930 Kc.

INDIA'S transmission to Europe and Africa is now being heard on new frequencies, and the transmission time, 5.45-6.45 am, is providing good signals in this area. The frequencies of 12020 and 15245 Kc are used to Europe. while the service toward Africa is released on the 15105 and 17730 Kc frequency.

VOICE OF BRITAIN is the slogan of the new broadcaster in Cyprus, which has been used to relay the Arabic service of the BBC for the Near East listeners. The station is actually the well known Shaq el Adna transmitters, operated by the Near East Broadcasting Service, the only Arabic commercial station in the Arab world. The transmitter at Limmasol continues to operate on 6135, 6790, 9655 Kc.

BORNEO station Radio Sabu, Jesselton, which now operates on 7180 kilocycles, and the transmission schedule is 2.15-3.45 pm, 7.30-10.30 pm.

LOURENCO MARQUES has been noted on California on the new frequency of 9635 Kc from opening at 2.00 pm with the transmission in English, strength is fair till 3 pm, when there is interference from Tangier. The transmission at 3.00 pm in Portuguese which was recently on 11982 Kc has been reverted back to the 19 metre frequency of 15080 Kc and signals can be heard in this transmission at good strength at 3 pm.

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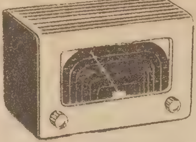
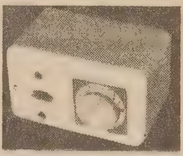


1 VALVE KIT SET

For the Learner

Although this little Set is quickly and simply built it looks like a factory job. The wooden cabinet is covered with burgundy leatherette and the dial has all Australian Stations marked in different colors. Parts are mounted on a wooden baseboard and any one can build it if they can use a soldering iron. Circuit diagrams, wire, solder etc,. supplied. Price of complete Kit of Parts, including Valve, Headphones and Batteries. Normal price £8/5/-.

Our Price £5/19/6



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Dimensions 5in x 3in x 3in. Cabinet is made from cream plastic, fixed detector, very easily operated. Price less headphones £2/13/6. Price complete with Headphones, 100ft Aerial wire and 2 insulators.

Only £4/17/6

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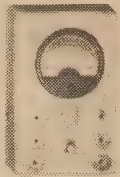

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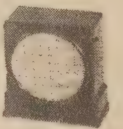
This multimeter is ideal for the hobbyist, motor mechanic, radio serviceman and electrician.

Price Only £4/12/6



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Walnut cabinets only 5/- each.

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★ SPECIALS ★

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6. 60 ma Chokes 30 henry 400 ohms an excellent job. Worth 35/-. **Our price 19/6.**

7. 40 ma Chokes 15 henry 500 ohms. Worth 21/-. **Our price 13/-.**

8. Low Tension power Chokes on heavy iron core 50 m. henry, 3 amps .5 ohms. These were made for use in Vibrator sets but are suitable for rewinding for all types of small transformers. **Only 2/6 each.**

9. 7 C 7 Valves. These pentode valves are suitable for either RF or AF Amplifier. 6.3 volt filament. Brand new and boxed. **Price only 3/6 each.**

10. Loctal Sockets to suit 7 C 7 Valves. **2/6 each.**

11. VCR 138 Cathode Ray Tubes. Ideal for use in oscilloscopes. 3½in diameter screen. **25/- ea.**

12. Philips Transistors.

OC 50	**£4**	**8**	**2**	**ea.**
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OC 70	**1**	**11**	**3**	**ea.**
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13. **5 Button Push Button Switches.** Each unit consists of 4 push type 2 way switches and one DPST. push type switch. Ideal for intercom., phone and speakers, also station selectors on radio receivers. **Price only 7/6 each.**

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★ SPECIALS ★

15. 5 BP1 Cathode Ray Tubes. **only 29/6 each.**

16. **Genemotors type PE94A** Input 28 volts, output 300 volts DC at 260 ma 150 volts at 10ma. 14 volts DC at 5 amps, Enclosed in a metal case with cooling fan, carbon pile regulator and efficient filter could be converted to 32 volt motor **Price only 19/11.**

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Gauges Prices per yard.

B and S	SWG	E'melled	SCE	SASE
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19	20	4d	5d	5d
22	23	3d	3d	3d
24	25	2d	2d	2d
26	27	2d	2d	2d
27	29	2d	2d	2d
28	30	1d	1d	1d
29	31	1d	1d	1d
30	33	1d	1d	1d

18. Bakelite former can be supplied cut to the length you require.

Diameter	Price per inch
1in	5d
1¼in	6d
1½in	6d
2in	8d
2½in	9d
3in	10d

19. **Electric Shaver Packs.** These units connect to a 6 or 12 volt battery and enable any 230 volt AC, DC. shaver to be used when you are camping, boating etc. Suit Philishave, Shavemaster Remington etc. Brand new and guaranteed Worth £8/15/- 6 volt model **Only £4/13/-.** 12 volt model **only £5/13/-.**

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USING A 5-inch TUBE FOR TV

From Page 71

een area between it and the 5BP1 iot very great.

Vith either type, the matter of screen mination is likely to be a problem, ce they have been designed for oscil-raphic rather than television service. s wise therefore to provide an EHT not less than 2000 volts. In fact, if l deflection is still possible, the 5BP1 ı be operated at 2200 volts and the R97 at 2500.

As most readers will realise, push- up the final anode voltage reduces deflection sensitivity.)

MITED BRIGHTNESS

Because of the limited screen bright-s and the green color, the picture ist be viewed in more subdued light ın a full-sized receiver. Some experi-nters have found that better contrast d a more acceptable picture results an orange-coloured filter is placed front of the tube face even, for ample, a piece of orange cellophane.

In this connection, a few 5CP1 tubes pear to be available. These are nerally similar to the 5BP1 but have additional accelerator electrode ich, reportedly, can be connected to final anode, to produce much ghter image than a 5BP1.

Questions have been asked about the in tubes on the market, such as the CR511B. These require an EHT of out 5000 volts and present consider-le difficulty in the matter of deflec-n. One could not expect to obtain fficient deflection, for example, from nplifiers designed for a 5BP1 or CR97.

The requirement is for an extremely gh audio voltage swing on the deflec-r plates. Readers who have experi-ented with these tubes report some ccess by using 6SH7 valves, resist-nce-coupled but using extremely high ate supply voltages.

By providing a supply voltage of about 0, with screen and bias voltages set limit plate (and screen) dissipation, ry high deflection voltages can be tained without, apparently, wrecking e 6SH7s.

ONG PERSISTENCE

Many of these 12in tubes are ex-dar display tubes with quite long per-stence screens. In some cases, the itial brightness falls rapidly but a low-tensity image is retained for a very ng period.

Television images are likely to suffer om highlight interference remaining om earlier images but the effect is pparently not so bad as to prevent the se of these tubes on an experimental asis.

It is suggested, however, that such ubes be checked if at all possible before o much work is done, building a re-eiver around them. Slow air leaks, leterioration of cathodes, etc., can easily ave occurred during long periods of torage. Most disposals tubes are now rom 10 to 15 years old.

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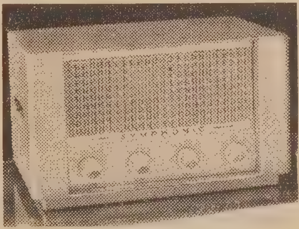

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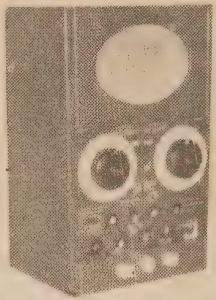
Amplification Communication Electronics

DULWICH HILL, UNDERCLIFFE, EARLWOOD
EVENINGS and WEEKENDS: "KALUA"



AR8 COMMUNICATIONS RECEIVER

12 valve. Converted to 240v A.C.
Thoroughly Tested. Re-aligned
Latest Ovaltone Permag Speaker
Noise limiter added.
£34/17/6

NEW AMERICAN SELSYN MOTORS

50 volt Transmitter
£2/17/6
Slaves—£1/17/6

ALUMINIUM PANELS

11in x 9in. 18 gauge.
2/9
POSTAGE
N.S.W. 1/- INTERSTATE 2/6

NEW TELEPHONE WIRE

American 7 strand Rubber Insulated
½ MILE DRUMS, 15/-
CASE OF 6 DRUMS, 3 MILE £4/-/-
DON 8 WIRE, 3 MILE £10/-/-

Throat Mikes New 3/6
12V 420 watt Prefocus Globes 7/6

NEW C.R.O. TUBES

All tested on TV Picture
VCR 97 .... £2/17/6
ACR2X & Shield £3/10/-
CV254. 9" Blue Screen, Magnetic Deflcetion & Focus
£4/10/-

Every tube capable of perfect picture. Fast persistance and simple construction using standard components.

NEW 240-110 TRANSFORMERS 160 V-A

£1/17/6
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AR8-AT5 — COMPLETE STATION

AIR TESTED

Transmitter-Receiver, Aerial Coupler
Cables, Plugs, Phones, Mike
1 Crystal to desired Frequency.
24V Power Supply & Circuits of 2 units
GUARANTEED IN PERFECT ORDER
£62/10/-
Other voltages available.

NEW B.S.R. FP10 GRAMO MOTORS

240 or 110
FOR THAT TAPE RECORDER
£1/19/6
POSTAGE 2/6

NEW VALVES

217C	£1/10/-	KT66	27/6
6J8	17/6	X61M	17/6
12C8	12/6	12K8	12/6
VT501	12/6	VT502	12/6
7C5	12/6	6E5	12/6
EBC33	12/6	7A6	7/6
1H6	7/6	AV11	3/9
6L6	20/-	832A ..	£3/0/0
1C6	12/6	6K7	7/6
1D4	12/6	1K5	2/6
1G4	12/6	12SJ7	12/6
1J6	12/6	12SK7	12/6
1K4	12/6	12SL7	12/6
1K6	12/6	39/44	10/-
1LH4	12/6	46	12/6
1LN5	12/6	4	12/6
1P5	12/6	78	12/6
1R4	12/6		
A6	12/6	809	£2/0/0
3A4	15/-	828	£2/10/0
3B7	10/-	843	£1/10/0
3D6	10/-	957	6/6
6AG5	9/6	1619	£1/0/0
6AM5	15/-	1625	£1/0/0
6AM6	17/6	1629	10/-
6H6	7/6	2050	£1/0/0
6J6	15/-	4307A	10/-
6J7G	9/6	9001	8/6
6N7	10/-	9003	12/6
6SK7	12/6	9004	8/6
6SL7	12/6	RK75	10/-
6Y6	17/6	RK48A ..	£3/0/0
10	15/-	VR75/30 ..	15/-
12A6	12/6	VR105/30 ..	15/-
12H6	7/6	VR150/30 ..	15/-
KTW62/6U7	7/6	NR74	7/6
2A3	£1/-/-	ATP35	12/6
5U4	12/6	954	7/6
1M5	7/6	1T4	12/6
1D5	7/6	5X4	12/6
CV6	3/6	1C7	7/6
6F6	12/6	1A5	7/6
813	£3/0/0	7193	3/6
VR65A/SP41	2/6	829B	£4/10/-

NEW

ELGIN 8-DAY AIRCRAFT CLOCKS

Panel Mounting. 2¼in. Sweep Second Hand. Cost RAAF £28/10/-.
Ideal Car Dash Clock.
£7/10/-
POSTAGE 2/-

NEW

12V. GENEMOTORS

American. 12V. Input.
270 V. 100 M.A. Output.
£4/15/-

PHILIPS SIGNAL GENERATORS

101C
Thoroughly Tested and Calibrated.
Guaranteed Perfect Order.
£29/10/-

OSCILLATOR

144 MEG V.F.O.
Simple to use as Transmitter.
Complete with 2 Valves.
7193 x 646.
19/6
Postage NSW 2/6. Interstate 4/-.

RELAYS

1700 SPDT 7/6
1300 SPDT 7/6
500 x 500 SPDT 7/6
12 volt DPDT 5 amp £1/-/-
24 volts DPDT 12/6
8-16 volt DPDT 12/6
11 volt AC £1/-/-
Hi-speed Polarised relay .. £2/10/-
400 ohm 12/6
1300 ohm DPDT 15/-
½in Square Section DURAL TUBING UP TO 12ft lengths 1/- per ft.
Hi-Lo Phone Transformers .. 4/6
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Canadian Signal Lamps 12/6
Hi-Voltage Lead-Thru Insulators, 1/6 each, 15/- doz.
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Tx. Var. Condensers, 300 pf £1/5/-
100 pf £1/1/-
60 pf with Vernier £1/1/-
30 pf 10/-

RADIO

PHONE LA 3845

6 VICTORIA R'D. MARRICKVILLE. SYDNEY, N·S·W

TRAM AT DOOR. STOP 42

OLLAROY ST., COLLAROY — XW5956

A.W.A. 3.B TRANSMITTERS

12 volt operation
3 to 9 megs. 10 watts output
Airtested, complete with 1 crystal

£29/10/-

NEW AMERICAN MINIATURE MOTORS

huntwound, 5600 RPM with gear box.
10 x 1 & 25 x 1 reduction

V 7 amp	£3/17/6
V 1.4 amp	£4/7/6

Postage, NSW, 3/- Interstate 5/-

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6V. 12V. 24V. 32V. DC to
) Watt to operate Radio, Fluorescent Lights, Shavers, etc.,

£8/17/6

NEW TRANSFORMERS

FERGUSON

VIBRATOR TRANSFORMERS

50 x 150 40MA. 6V	£1/4/6
002 x 300 100 6V	£1/17/6
25 x 325 125 12V	£3/12/6

INVERTER TRANSFORMERS

6V 240V 40 watt	£3/7/6
2V 240V 60 watt	£3/7/6
2V 240V 60 watt	£3/7/6

C.R.O. TRANSFORMERS

350 x 350 extended to 1000V
5.3V 6.3V 215V 4V **£4/5/-**
POSTAGE N.S.W 5/- INTERSTATE /6

DIODE VOLTMETERS

2 ranges to 400V
Tested good order
Meter basic 100 microamp

£3/7/6

POSTAGE N.S.W. 5/- INTERSTATE 7/6

New Coils and Intermediates standard or miniature to suit all valves.

Coils B/C 455 KC	9/6
Coils S/W 455 KC	9/6
Inters	11/6
Loop aerial coils	9/6
Slug tuned H.F coils suit 144 meg	4/6

NEW

SELENIUM RECTIFIERS

500 V. Halfwave.

300 MA	£2/-/-
600 MA	£3/-/-
1.2 AMP	£5/-/-

250V In 500V Out **£2/-/-** Doubler 300 MA

NEW CONDENSORS

.1 .25, .04, .02, .01, .005, .003, .004, .0001,, .001.
Any 1 size or assorted.

£1/10/- per 100

Postage, NSW, 4/-, Interstate 7/6

WANTED

Communication Receivers Test equipment, P.A. gear. Large or small surplus stock, Best prices. Call, write or phone any time.

OIL FILLED CONDENSERS

1UF 600V 6/6 .5UF 2.5 ... 6/6
4UF 750V 12/6 .5UF 400V .. 6/6
10MFS 500 7.5UF 330V AC 10/-

SCA 522 RECEIVERS

Complete front end and IFs less valves. A ready made 144 meg. or vehicle band converter.

£2/17/6

Photostat circuits

10/-

MAGNETIC PAPER DISC RECORDERS

Recordon. Electronic Secretary. Complete with Mike, Phones, Foot Switch. Air tested

£37/10/-

813, 832, 829 SOCKETS

20/- ea. post 1/6

P.M.G. JACKS & PLUGS

4/6 pr. Post 1/-

UNIVERSITY V.C.T. UNITS

Roller value chart tested. All ranges.
Perfect order

£22/10/-

MULTIMETERS

AC-DC
5-50-100-250-1000V
1-5-25-100-500-MA

2 RANGE OHMS
TESTED ALL RANGES

£8/17/6

Telephone Equipment

Hand sets	£1/9/6
Mike inserts	3/6
Head & breast sets	17/6
Hand sets with pressel switch	£1/15/-
Hand generators	10/-
Adjustable buzzers	7/6

Miniature telephone units to suit. Hand sets or H & B 10/-

NEW

MONITOR UNITS

240V. 50 A.C. Powered. Addition of H. & V. Amplifier Converts to first class CRO

£15/-/-

LIGHTING PLANTS NEW

2.75 KVA. 240V, AC, Single Phase, 50 cyc. Coventry Climax Powered by 4-cylinder, 7 H.P. Petrol Engine. Complete with Control Panel. AVR, Freq., volt & ammeter.

£135

Weight Packed 3½cwt.

12v DC 300 watt Chore Horse or American Briggs & Stratton

Powered by 1 h.p. Petrol Engine. Air Tested
Perfect Order

£32/10/-

New American miniature

BLOWER MOTORS

12 or 24 volt Permanent magnet fields

£1/7/6

Postage: NSW, 1/-; Interstate 2/

12 VOLT GENERATORS

New C.A.V. 80 amp Generators. Ideal for lighting or fast chargers

£10/10/-

10-line TELEPHONE SWITCHBOARDS

May be used as single magneto ringing phone, or up to 10 lines as required. New Condition Tested.

£5/10/-

6-lines (as above) £4/5/-

GENEMOTORS

Input	Output			
24V	250V 100MA	£1	0	0
24V	550V 375MA	2	0	0
24V	250V 60MA	1	5	0
12V	500V 350MA	8	10	0
12V	1200V 200MA	6	10	0
6V	500V 150MA	6	10	0

A C E

Amplification Communication Electronics

RADIO

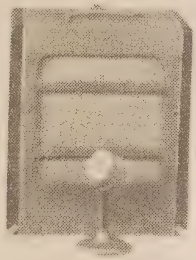
PHONE
LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N·S·W
AND 636 KING STREET, NEWTOWN

EVENINGS and WEEKENDS: "KALUA", COLLAROY ST., COLLAROY — XB5956
DULWICH HILL UNDERCLIFFE, EARLWOOD, TRAM AT DOOR, STOP No. 42

AMPLIFIERS

FROM £14/17/6



6 valve general purpose 10 watt in plastic covered case Complete with heavy duty Jensen speaker, crystal mike and stand. Input for pickup, mike, guitar tuner

£31/15/0

PUBLIC ADDRESS RANGE 340V-AC

6 valve	10 watt	£14/17/6
6 valve	25 watt	£25/ 7/6
6 valve	40 watt	£32/ 7/6

BATTERY ONLY OPERATION

6 valve 6 volt 10 watt £18/15/-
7 valve 12 volt 10 watt £19/15/
7 valve 12V. 25 watt £24/17/6

BATTERY AND A.C. OPERATION

6 valve 10 watt 6V. £20/15/-
7 valve 12 watt 12V. £21/15/-
7 valve 25 watt 12V. £29/7/6

HI-FI RANGE MULLARD 5/10.

£34/15/0

Complete with Jensen twin cone speaker, Ferguson O.P. transformer, 301 & U.L. taps.

MULLARD 5/20 AS ABOVE

£42/15/0

Tuner & separate control box with mike, pre-amplifier.
£12 extra

10-VALVE HI-FI

RADIOGRAM CHASSIS

Incorporating Mullard 5/10 bass boost amplifier, treble boost, dual wave tuned R.F. stage. Built-in pre-amplifier for microphone or tape recorder including Jensen twin speaker

£42/15/0

Dual wave, 6 valve radiogram chassis. Includes bass & treble boost, 12" Jensen or Magnavox speaker

£23/15/0

8 VALVE RADIOGRAM HI-FI CHASSIS

Dual wave, bass & treble boost tuned R.F. stage 12" speaker

£28/17/6

5 VALVE RADIOGRAM CHASSIS DUAL WAVE, 12" SPEAKER

£18/15/0

5 valve also available as home constructor's Kitset **COMPLETE WITH CIRCUIT.**

£14/15/0

7 VALVE DX RECEIVER

3 band, 2 to 6 and 6 to 18 megs 160 to 16 meters and broadcast. Exceptional selectivity, sensitivity 2 microvolts. **NEW AUSTRALIANS,** listen to European short wave stations.

£29/17/6

T.V. EQUIPMENT

Formers in cans with special V.H.F. tuning slugs and winding data for video and sound I.F.S. and traps ...... 9/6 ea

E.H.T. Transformers for 3000v £1/15/-ea
5000v insulation Fil Transformers £2/-/-ea.

Video and sound I.F.S. ratio detectors and traps to A.W.A. circuit specifications Pre-aligned. .... 19/6ea.

Wired and tested video and sound I.F. strip with traps and ratio detector including valves and circuit. Including valves £21/-/-

Wired and tested. Strip as above, but using new ex-disposal valves and circuit, etc. £17/-/-

N.B. All equipment complies with P.M.G specifications.

Turrets, line transformers, yokes, deflection coils and standard 17" tubes available. Also first class technical and alignment service.

3 SPEED PLAYERS

All makes from

£11/17/6

3-SPEED CHANGERS

£15/17/6

Portable carrying cases, £4/17/6, Players, Changers £6/15/-

CAR RADIO

A complete range for 6V or 12V as required. Standard fitting

5 valve	£30/9/0
6 valve	£35/14/0

Tailored to fit late model cars

5 valve	£35/14/0
6 valve	£43/2/0
8 valve	£52/10/0

All installation fittings, suppressors, aerials etc. are included.

R & H KARSET KIT 1956

Complete with aerial, installation accessories, etc. **£31/15/-**

Wired and Tested £35/15/0

Also available for special frequencies. Small Ships, Bush Fire Brigades, Flying Doctor Service etc., at same price.

HOW TO INSTAL YOUR NEW KARSET

(Continued from page 55.)

rs and the ignition suppressor it is ne to make our first test. Close the onnet (this is most important), switch n the set, and start the motor.

Ideally there should be no interference ven with the set tuned between stations nd it is possible that you may achieve is order of performance, or something ery close to it, at the first attempt. But this ideal is not achieved, don't be o disappointed; there are still plenty tricks you can try, usually with arked benefit.

NTERFERENCE SOURCES

First thing to do is to decide the ature of the interference. The most kely possibilities, in order, are (1) ignion interference, (2) generator whine,) vibrator hash, and (4) interference om some electrical accessory in the r.

The last named condition is rare, but can happen. The writer once spent any minutes trying to track down a ysterious slow rhythmic clicking sound hich commenced as soon as the ignion was turned on, and ruined an otherise perfect installation. It was finally aced to the dashboard clock, which rned out to be electric rather than ring driven. An extra by-pass from s active terminal quickly silenced it.

More obvious forms of interference ay come from windscreen wipers, fans, r other small motors. By-passing normly effects a complete cure.

IBRATOR HASH

If vibrator hash is experienced in the ar, but not on the bench, it is probably ue to poor bonding between the reeiver case and car chassis, or between ne earthy side of the power supply and ne battery terminal. This can cause a roportion of the LT current to flow rough the lead-in earth braid.

Generator whine is not usually roublesome and the single by-pass is ormally a complete cure. However, ases have been known where normal nethods were inadequate. While it is isually quite satisfactory (and a good leal easier) to by-pass the generator at he voltage regulator it will sometimes e found that by-passing right at the generator is essential. Sometimes it may e necessary to by-pass both points.

If all reasonable methods fail it may ndicate that the generator is in need of ttention. This may vary from simply leaning the commutator with fine glasspaper to having the commutator trued p in a lathe.

GNITION NOISE

Finally there is ignition noise, the east amenable of the lot. This is easily ecognisable as a rhythmic clicking sound which varies with engine speed. The list of suggestions may look formidable, but t must be realised that no one car would equire them all. On the other hand, no one measure is likely to effect a omplete cure. Any measure which affords any relief should be made permanent, the cumulative effect of several "small" improvements being quite marked.

First, however, it is a good idea to disconnect the lead-in at the set and observe whether the noise is entering via the aerial or the LT wiring. In the light of this test it is often a good deal easier to decide what steps are most logical to try first.

If the noise appears to be coming in through the aerial, try the following:

Check the lead-in bonding thoroughly at both ends. Try additional bonding points.

Note whether opening or closing the bonnet makes any difference and, if not try bonding it to the bulkhead. Also bond to the bulkhead all control rods which pass from the engine inside the car.

BONDING

Bond various body panels either to chassis or to each other. This applies particularly to older model cars.

Bond the steering column and dash to chassis. Bond the transmission and exhaust muffler to chassis. Bond the engine itself if it is rubber mounted.

Bond speedo cable, oil pressure cable and petrol gauge line to the instrument panel.

Where a built-in aerial is used, bypass the wiring to the roof light. This also applies if whip aerial is used with fabric-topped sedan.

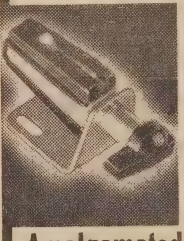
Enclose HT wiring in a metal tube earthed to the engine block. If this is already provided, try removing LT lead from group and tape to outside of tube.

ALL WORTH TRYING

If the noise is still present when the aerial is disconnected, try additional bypassing of the LT line and try other pickup points, if necessary taking the lead right back to the battery. The same applies to the earthy LT lead. If additional bypassing appears to be necessary, check whether it is only a change of earth point that is required.

As we said earlier, it is unlikely that all the measures suggested will be needed, or even helpful, but they are measures which have been found beneficial in particular cases in the past. As such they are worth trying in a sticky case.

LET US FIT A
HAMMERSON
DIAMOND
STYLUS
TO YOUR PICKUP—AND SAVE WEAR ON YOUR RECORDS
(Guaranteed six months)
A HAMMERSON DIAMOND WILL OUTLAST 40 SAPPHIRE
Pickups heads or shanks may be sent through your usual retailer or wholesaler for diamond or sapphire retipping Prompt Service. If your dealer cannot supply contact us
PRICES (Fitted) LP or 78:
Diamond £7/2/6 Sapphire 19/1
(Plus 1/6 regd. post.)
HIGH FIDELITY INDUSTRIES
144 PARKERS ROAD, PARKDALE, S12, VIC.
TRADE ENQUIRIES INVITED

AWA RONETTE
MICROPHONES & ACCESSORIES

Type TO-284
£2/15/3
Turnover pickup cartridges for standard and long play. Available in alternative response characteristics as models OV, P, T, TS.
Amalgamated Wireless
(AUSTRALASIA) LIMITED,
167 Queen St., Melbourne.
and leading wholesalers.

AUSTRALIAN BROADCASTING COMMISSION
Offers a CAREER in
TELEVISION
with the
TECHNICAL STAFF
(Sydney or Melbourne)
in the installation, operation and maintenance of TV studio, mobile van and microwave link equipment.
PERMANENT POSITIONS ARE AVAILABLE FOR—
Qualified Technician — in categories from Technician to Supervising Technician. (Salary, according to experience, from £842 to £1497 p.a. and subject to shift and overtime loadings.)
Benefits include Commonwealth Superannuation, Long Service Leave, Sick Leave, etc. Apply to the Chief Personnel Officer, Box 487 G.P.O., Sydney — or for further particulars write or ring Engineering Department, 195 Pacific Highway, Artarmon (JF5624-5-6), or 473 St. Kilda Road, Melbourne (BM3211).

NEW VALVES

IQ5	9/6	6K8G	11/6	6F6	9/6	EZ82	9/6
IT4	13/6	71A	7/6	EL32	9/6	117N7	15/-
IR5	15/-	EK32	15/-	12A6	12/6	4307A	10/-
IS5	15/-	6J8	15/-	6J7	8/6	5Y3GT	12/6
3S4	15/-	6K7	7/6	5U4	12/6	12SR7	3/6
3V4	15/-	KTW62/6U7	7/6	6SN7	10/6	1H6	7/6
IK5	2/6	EF8	9/6	954	5/6	1J6	7/6
IL5	9/6	7C7	3/6	955	5/6	ID8GT	10/-
IC7	9/6	7A6	3/6	VR150	15/-	1D5	9/6
6U7G	7/6	78	7/6	VR65A	2/6	9001	5/-
6G8G	11/6	6AG5	10/6	EBC33	9/6	81	15/-
6SA7	9/6	6B8 Metal	12/6	AV11	5/-	34	5/-
6SQ7	9/6	32	5/-				

ALL VALVE PRICES PLUS POSTAGE

RELAY-TYPE COUNTERS

("Mercury" American Made) These relay counters register from 0 to 99.999. Can be supplied with 250ohm coil. 24v D.C. operation.

25/-

Plus Postage.

NEW 5-VALVE D.W. VIBRATOR CHASSIS

These Chassis, by leading manufacturer, are new but shop-soiled. Are supplied in working order and complete with valves, Rola 6in x 9in Oval Speaker, Slide Dial and Vibrator, supply (6v).

List Price over £40.

SPECIAL PRICE,

£15/15/- F.O.R.

Ideal for Boat, Caravan, etc.

NEW AMERICAN INDICATOR-UNITS

Containing 12 Valves.

1- 3 B.P.I. in Separate Shield, 7-6SN7, 1-2x2, 1-6x5, 1-6H6, 1-6G6.

£8/17/6 F.O.R.

C.R.O. TRANSFORMER

240V PRI. SEC. 350V x 350V. Extended to 900V 2-6.3V and 2-5V Fil.

Post N.S.W. 5/6; Interstate 8/-. £3/5/-

Suitable for changing above Indicator to 240V Operation

A.C. AMP. METERS

A.C. Amp. Meters (ex-County Council). A necessity in any electricity workshop.

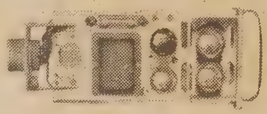
RANGE: 0-5 amps. (can be extended by shunts). DIAMETER: 7½ inches.

28/6 F.O.R.

By Rail or Air Freight Only

Too heavy for Post

FOUR-VALVE AMPLIFIER



Four-valve audio amplifier, made in America. Supplied with two 7C5, one 7F7 and one 7Y4 valves, trans. res., etc, mounted in brocaded finished case.

Post N.S.W. 5/6

Int. 7/6 38/6

NEW AMERICAN BOX KITES

These kites are constructed of Silk with Aluminium Frame.

SIZE 15in square x 3ft long.

Originally used for Aerials for Lifeboat Transmitters.

30/-

Post. 2/-.

NEW 1000 K.C. CRYSTALS

For Bendix Frequency Meters. Made by General Electric. American Octal Base.

£7/15/-

P.M.G. TYPE RELAY-COUNTER

0—9,999

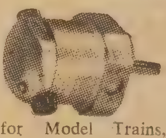
1.300 ohm coil 15/-

NEW ENGLISH T.C.C. HIGH VOLTAGE PAPER TUBULAR CONDENSERS

	Each
.01-1000V	1/9
.02-1000V	1/9
.05-1000V	1/9
.02-1500V	2/-
.05-1500V	2/-
.1-1500V	2/6
.05-2000V	2/6

All plus postage.

24-VOLT MIDGET MOTORS SHUNT WOUND



Fully Laminated Fields. Wound Armature. Sixteen Segment Commutator, ball-bearing. Ideal for Model Trains, Hobbyists, etc. Condition New.

Price, each 32/6

Packing and postage: N.S.W., 1/6; Interstate, 2/6.

A.T.5 TRANSMITTERS

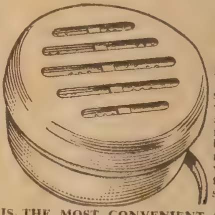
Complete with Valves, 2-807, 2-6V6

£4/17/6 F.O.R.

LESS VALVES:

£2/17/6 F.O.R.

PILLO-FONE
EXTENSION UNIT



IT'S A REAL MINIATURE WITH ROLA UNIT.

Install it anywhere, in the sick room, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The 'PILLO-FONE' IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED. 3½in Diameter by 1¾in deep.

POST FREE 22/6

NEW 12V GENEMOTORS

American Manufacture.

Input 12V, Output 240V at 100 M.A.

£4/15/-

CERAMIC TRIMMER CONDENSERS

Small 7-plate O-20 PF 3/6

Small Tubular, O-20 PF 2/-

Please address all correspondence to 479 Parramatta Road, Leichhardt, N.S.W.

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640 KING STREET, ST. PETERS, N.S.W
PHONE LA6087

479 PARRAMATTA ROAD,
LEICHHARDT, N.S.W. PHONE LM3610

ELECTRO SPECIAL

Box of 36 new standard Electrolytic Condensers, including 12 8mfd/525v 24mfd/350v, 50mfd/200v, 10mfd/40v, 500mfd/12v, 250mfd/12v, etc.

59/6

Plus Postage: N.S.W., 3/6; INT. 5/6.

NEW POWER TRANSFORMERS

60ma prim. 240v with 230v tapping. Sec. 285 x 285 with 6.3v filament winding.

24/6

Plus Postage: N.S.W., 3/6; INT. 5/3.

MICA CONDENSERS

Standard Mica Condensers, small current types. .00003 to .005 including most wanted values.

25/- per 100.

Postage 1/6.

Electrolytic Condensers

12mfd 525v	4/6
16 x 16 mfd 350v	4/6
24 mfd 350v	3/3
20mfd 200v	2/6
250 mfd 12v	1/6
30mfd 350v	3/6
500mfd 12v	1/6
8mfd 350v	2/6
10mfd 40v	1/6
8mfd 525v (miniature)	4/6
8mfd 525v	3/6

(Plus Postage)

12-inch P.M. Speakers

Heavy duty 12jn per-mag speaker by well-known manufacturer. 10T, CT, or 5000 Transformer, £2/17/6

Postage: N.S.W. 5/6; INT. 7/6

CONDENSER SPECIAL

Boxes of 100 new mica paper and electrolytic condensers in values ranging from 50pf. mica to 5 400v paper. Values include .0001, .00025, .00075, .01, .02, .05, .1. Also 500mfd/12v, 10mfd/40v, 8mfd/525v 16mfd/350v electrolytics.

30/-

PER 100

Post Extra: N.S.W. 2/6; INT. 3/6

NEW 5in PER-MAG SPEAKERS

5C Standard	22/-
5F Heavy Duty	24/-

Supplied with 5T, 7T or 10T Transformer.

Postage Extra: N.S.W. 2/3; INT. 4/6

6in x 9in Oval Dynamic Speakers with 5T or 7T Transformer.

27/6

Postage Extra: N.S.W. 2/9; INT. 4/6

New Carbon Resistors, well known make. Mixed values. Colour code supplied.

7/6 per 100.

Postage 1/6

NEW ENGLISH B.S.R. RECORD PLAYERS 3-SPEED Liquidation Stock

These players, Model GU4A are fitted with turnover crystal pick-up. Finished in cream and brown.

SPECIAL PRICE

£8/17/6 Plus Postage, Packing, NSW 9/6: Int. 18/6.

Plastic covered portable cabinets for above .. .. .. **£4/15/-. F.O.R.**

NEW STROMBERG CARLSON SINGLE SPEED RECORD CHANGERS

With Crystal Pick-up

£4/19/-

F.O.R.

I.F. TRANSFORMERS

Standard I.F. transformers square can (1 3/8) 455K.C. permatuned, **4/3**

(Plus Postage)

SAPPHIRE NEEDLES

Rothermel sapphire needles play 2000 recordings. Made in England. Each **2/9** or **25/-** dozen.

POTENTIOMETER SPECIAL

Box of 24 new Carbon Potentiometers containing 4 miniature .5 meg. switch pots. long spindle D/P switch—4 standard .5 meg. long spindle—4.1 meg. miniature long spindle and 12 mixed, some with short spindles.

57/6

Plus Postage: N.S.W. 3/6; INT. 5/6

New Coils and Intermediate Transformers to suit all valves.

B/C Coils, shielded	9/6
S/W Coils, 16 to 49 Meters	9/-

Aerial R.F. or OSC Inters. 455Kc.

11/6

I.R.C. RESISTORS

100 I.R.C. carbon resistors, ½, 1 and 2 watt, in values 50 ohm to 5 meg. including many popular sizes, 3T, 15T, 20T, 25T, 50T, 100T, 250T 500T, etc. (Standard resistor color code supplied.) Box of 100,

£1/-/- Plus 1/6 Postage

New Midget Power Trans.

40MA Prim. 240v. Sec. 225 x 225 with 6.3v Fil. Winding. Upright, or Flat Mounting. Size 2in x 2½in.

22/6 2/6 Postage N.S.W., Interstate, 4/6

MERCURY SWITCHES

The switch with 1000 uses .. **2/6**

Postage 6d.

HOOK-UP WIRE

(10—, 010)

Rubber-covered—**6/9** 100ft.

Rubber and glazed Cotton push back, **10/-** 100ft.

Glass insulated **8/6** 100ft.

Postage Extra

POTENTIOMETERS

½ Meg. Miniature Switch Pots. D/P Switch, Long Spindle	5/6
.1 Miniature Long Spindle	3/6
Standard ½ or 1 meg. switch pots, long spindle d/p switch	5/6
½ meg. or 2ST. ohms short spindle switch pots	2/6
½ meg. or 100T standard pots long spindle	3/6
½ meg. or 100T short spindle,	1/9
5 meg. high insulation	5/-

All Plus Postage

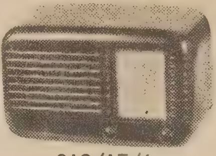
Please address all correspondence to 479 Parramatta Road, Leichhardt, N.S.W.

METROPOLITAN RADIO SUPPLIES

640 KING STREET, ST. PETERS, N.S.W.
PHONE LA6087

479 PARRAMATTA ROAD,
LEICHHARDT, N.S.W. PHONE LM3610

MAKING UP THE "LITTLE GENERAL"?



£12/17/6

Post and Packing N.S.W., 14/6.
Interstate, 25/-.

—THE IDEAL XMAS PRESENT—

Complete kit of parts for the 1956 "Little General" as featured August R & H including attractive bakelite cabinet with slide dial. Price includes valves and Rola 5F speaker and kit is complete to the last nut and bolt (Set wired and tested £2/15/- extra). Cabinet size 11½in long, 7in high, 6in deep.

Foundation Kit for above comprising Bakelite Cabinet, Chassis and Dial Assembly 57/6

MIDGET CONDENSERS

New seven plate midget condenser, ceramic insulation, standard single hole mounting ¼in spindle 0-30pf. 5/6

NEW SWITCHES

D.P. S.T. Rotary	2/6
Yaxley 3 x 3 SB	3/3
Oak 3 x 2 2B	4/6
Alpha DP/DT	3/3
Oak 1 x 2 SB	1/9
Oak 1 x 3 SB	2/-
Oak 4 x 2 SB	3/6

Post extra.

PUSH-BUTTON SWITCHES 20/-

Five pole push-button switches .. ..
New control box fitted with above switch also 5 bezels with globes and multi contact key switch.
Post N.S.W., 2/-; Interstate, 3/-.

NEW B.S.R. MOTORS

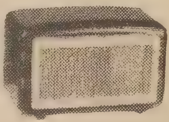
These English B.S.R. Motors as used on most tape decks, also have many other uses. Size of motor 3in x 2½in x 2¼in with 3/16in shaft, for 240 or 110 volt AC operation

NEW 39/6
Used, but in good condition 27/6
Post, N.S.W., 3/-; Interstate, 4/6.

NEW GRAMO-MOTORS

New H.M.V. spring gramo. motors, less turntable. Adaptable for many uses. 19/6
Postage N.S.W., 4/6; Interstate, 7/6.

Carbon microphone transformers, new, 4/6
Post extra.



Post and Packing
N.S.W. 10/6; INT. 16/6

NEW ROLA EXTENSION SPEAKERS

Rola 6-9L Oval Speaker, mounted in attractive bakelite cabinet with matching metal grille and complete with volume control.

£3/12/6

METAL RECTIFIERS

90 volt 200m.a. metal rectifier, suitable for operating relays, etc. 9/6

THROAT MICROPHONES

New American throat mikes Per pair, 3/6

SIGNAL LAMP GLOBES

Lucas signalling lamp globes, 10v. 6/- doz.

PRE-FOCUS GLOBES

12v. 420 watt 7/6
Post extra.

CREED-RELAYS

New creed relays supplied with mounting base £3/10/-

OIL FILLED PAPER CONDENSERS

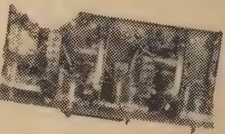
15mfd 600v.	10/-
8mfd tapped at 5mfd 10v AC	7/6
1mfd 400v.	2/9
.01mfd 500v	7/6
3MF 2000v.	17/6
1 x 1 400v	2/6

Post extra.

I.R.C. WIRE-WOUND RESISTORS

850 ohms, 50 watt adjustable 5/6
2,500 ohms 5 watt, 1/6 or 10/- doz
5,000 ohms 5 watt 5 p.c., 1/6 ea. or 10/- doz
4,800 ohms, 5 watt 5 p.c., 1/6 ea or 10/- doz
200 ohms 20 watt 10 p.c 2/3 ea. or 15/- doz
5,000 ohms 20 watt 5 p.c. 2/6 ea. or 20/- doz
1,000 ohms 20 watt 2/6 ea. or 20/- doz
750 ohms 30 watt 5 p.c 2/6 ea. or 20/- doz

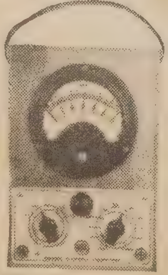
H.F. TUNING-UNIT



25/-
Plus
Postage

These H.F tuning units which are suitable for the 144Mc band contain three slug tuned coils, 7 plate ceramic trimming condensers, three acorn sockets (ceramic) and 3 new 954 acorn valves.

NEW UNIVERSAL-MULTIMETER



Manufactured by Robinson Electronics Laboratories, Incorporating 4½in World Famous American Weston Meter and High Stability Resistors.

This high-grade instrument is fitted in a durable and attractive Hammerton-finished case with self-contained batteries and supplied complete with test prods.

D.C. Ranges	A.C. Ranges	D.C. Current Ranges	Resistance Ranges	Output Ranges	PRICE
0-12V	0-12V	0-1.5MA	0-5,000 ohms	0-12V	£12/17/6
0-60V	0-60V	0-12MA	0-50,000 ohms	0-60V	Plus 12/6
0-300V	0-300V	0-60MA	0-500,000 ohms	0-300V	PACKING &
0-1,200V	0-1,200V	0-300MA			POSTAGE

Also Decibel Scale—minus 18 to plus 5db

Please address all correspondence to 479 Parramatta Road, Leichhardt, N.S.W.

METROPOLITAN RADIO SUPPLIES

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PHONE LA6087

479 PARRAMATTA ROAD,
LEICHHARDT, N.S.W. PHONE LM3610

THE MOVEMENT OF ANIMALS

(Continued from Page 19)

excitement) the speed of the fish can- ot be greater than four feet per second bout three miles per hour).

Secondly the fish is exerting its pull the end of a long lever. If the trout xerts a pull of half a pound at the end a 10ft rod, the rod can only be held ationary if, with our hands one foot part, each of our arms sustains a force four to five pounds. In other words, e sound that a running reel makes, nd the force that the rod exerts against ur hands, may give a very misleading npression of speed and power. A light d cannot safely be trusted to sustain a ll of more than about four ounces.

Sorry, gentlemen, but that is what the ofessor says.

HAT BIG FISH

And he says some more. He says at although the pull exerted by a fish ay be only one pound, our hand must stain a force of 12 to 13 pounds at the her end of a salmon rod. In other ords the big one that got away must ve been only a "tiddly". Really sorry, ntlemen.

The effect seems to be something like ying to lift a small boy on the end a long see-saw when the pivot or lcrum is only about a foot from your nds. He would appear to weigh many nes what he actually does.

The professor goes right into every- ing connected with jumping, creeping, d other forms of movement, including ing. Space does not permit more to said, but I trust that sufficient has en said to whet the appetite a little d urge further reading from this most markable little volume.

BUILDING YOUR OWN T.V. AERIAL

Continued from Page 101)

if you like, but we simply passed the reflectors through the boom and sweated them in place.

Using a 3/16 diameter tube for the small-reflector and ¼ diameter tube for the larger one.

Once again, in our case, the large reflector was made up as a tapered unit, using a 4ft length of ¼ tube and two shorter lengths of 3/16 tube.

When finally assembled, the aerial can be clamped lightly to the mast and the boom moved back and forth to balance the weight.

The final job on it is to sweat a few brass eyelets to the bottom of the boom and the side of the mast to carry the transmission line to the points of attachment already mentioned.

The array can then be polished up and given a coat of clear lacquer. Or again, you may prefer to paint the whole thing a neutral grey.

Thus far, you will have done all the work on the ground or in the workshop. From here on, attention switches to the roof area, where the aerial must ultimately go.

SELECTIVE SITING

Much has been said about selective siting of aerials and this may be important in critical situations. However, in the average domestic installation, practice is to put the aerial in the most convenient situation physically, the number of such situations being generally very limited.

If there is a choice, it should be kept to the side of the house remote from the street, both to avoid it dominating the house and to keep it away from ignition interference sources. However, avoid long lengths of transmission line, where possible.

Unless the receiving site is a very unfavorable one, there is no need to push the aerial to awkward heights. Above an iron roof it may need to be rather higher than above a tiled or slate roof, although this can be the subject of experiment later.

The means of attaching the mast to the house depends entirely on circumstances. Sometimes the mast is bracketed to a chimney, sometimes to a wall. Where neither method is suitable, a tile can be removed and the mast anchored to a ceiling joist and a roofing rafter, thence passing outside. This involves careful flashing of the hole to prevent rain leaks and should be avoided by the amateur, if at all possible.

The bottom section of the mast should be stout enough to prevent serious side sway, common practice being to use galvanised water pipe, guyed or stayed to the nearest convenient points.

As we said earlier, television aerial installations are subject in most areas to council inspection and shoddy, insecure installations may easily be condemned forthwith.

Local Government policy is not uniform in these matters and should be ascertained by inquiry from the local building inspector.

COUNCIL REQUIREMENTS

Some councils require prior application, with a sketch plan of the property, showing the position and nature of the proposed aerial. Other councils require advice only after the aerial has been erected, so that it can be inspected in situ.

Where application is made by a tenant, most councils require that the property-owner's consent be available in writing before the aerial is erected.

It would appear from discussion with various building inspectors that they are not primarily concerned with the type or appearance of the aerial system. Only if it is an obvious "eyesore" and likely to prejudice property values would it be likely to be challenged on these grounds.

They are, however, very concerned that the installation should be safe in itself and that it should not prejudice the structure to which it is attached.

Parts of the aerial should not project over the boundaries of the property concerned and, except by special permission, should not be more than 10ft above the roofing ridge, or more than 10ft above a flat roof, where such is used. It must be securely installed and braced.

Some councils prohibit the fixing of an aerial mast to chimneys or parapet walls less than 9in thick. Others will tolerate such an installation provided it is properly carried out.

CHIMNEY MOUNTING

One building inspector explained to the writer that he had no doubts that an ordinary chimney could readily support a simple array. However, attempts to plug such a chimney for a support within a few courses of the top could easily fracture the mortar bond and leave the top courses unattached.

Again, attaching a mast by means of wire was unsatisfactory, because the wire could slip into the space between bricks and cut away the mortar.

His policy was to pass chimney mounting provided the mast was secured to the chimney by suitable spacers and metal straps, protected at the corners.

So there it is. Armed with the foregoing information, readers should be able to go ahead and decorate their houses with a modern fan aerial. Only only problem remains—to get a television set to go with it.

HIGH-GAIN AERIAL ERVES ATN

(Continued from Page 15)

rd with reduced signal strength near e actual horizon.

This division of power and phasing obtained by the method of feed to the rial section, and by correct tuning of e dipoles.

Each of the dipoles has stainless steel gs, which may be adjusted for correct ngth.

The overall gain of the aerial is ex- mely high—between 14 and 16 times being due to the concentration of radi- ed power at low angles to the mast. the transmitter has a peak power of out 10 Kw, allowing for losses in the ed lines this provides an effective radi- ed peak power of about 100 Kw for e video carrier.

ATN operates on Channel 7, which vers 181-181 Mc.

Connecting link to the studio situated Epping is via a newly-designed micro- ve equipment, which has several annels around 7000 Mc.

The air-line distance of this link is out 7½ miles and it provides complete nal and communication facilities be- een the two points. Because of the wide frequency band required for TV it would be extremely costly, if not impracticable, to use co-axial cable over this distance. The link is in duplicate to safeguard against breakdowns. It was designed by the RCA Company of America.

The aerial for the link is also mounted on the side of the mast, and can be clearly seen from the ground.

MECHANICS' STETHOSCOPES
Ideal for Testing Engines 35/-

RUBBER BOATS
£6/15/-

Replace those broken side curtains with cellulose acetate which takes the place of celluloid and lasts four times longer. Will not discolor. [illegible]/6 SHEET.

SURPLUS STORES

512 Elizabeth St. Melbourne, C.1.
Phone: FJ5904 Just 4 doors from Victoria Street.
Mail Orders Carefully Packed
Include State in Address
Please add freight or Postage

ENGLISH SMITH 8-DAY CLOCK

Luminou Dial
£5/15/-
Makes ideal car clock
As used by the R.A.F

BINOCULARS BINOCULARS

£5 Allowance on Your Old Glasses. Here is your opportunity to dispose of those out of date field glasses as part payment on a modern pair of brand new high powered binoculars at the amazingly low figure of **£22/15/-** for 7 x 50, **£25/15/-** for 10 x 50, **£26/15/-** for 12 x 50, or **£29/10/-** for 16 x 50. Just mail old glasses to us with your remittance at the above price less £5 plus 8/- extra for reg. post.

SPECIAL OFFERS

Dental Mirrors, **2/6.** Parabolic mirror, **8/6.** Magnifying glasses, 8 mags, **8/6,** 10 mags., **12/6.** Headphones suitable for crystal sets, **17/6** pair. Tapped Transformers, 6, 12, 18 and 24 volts, 3 amps, **39/6.**

Spotlights, Army, 6 volt, **37/6.** Army Tank Aerial, 8ft, **15/-,** 12ft, **22/6.** Bases for same, **12/6.** RAAF Bomb Hoists, 33 to 1, **£10/10/-.** Tweezers, **5/6.** Watchmakers' Eyeglass, **6/6;** extra strong, 10 mag., **15/-.** Set of five Watchmaker's Screwdrivers, **13/9.** Dental Inspection Mirrors, **8/9.** New 0/5000 **Rev Counter,** 3¾in dial. Complete with drive, **£6/15/-.** Electric Engraver, works off 6 or 12 volt battery, **29/6.** Student Microscope, 300 mag., **£4/19/6.** 12 volt, 500 watt **Generators, £5;** 24 volt, 1000 watt **Generators, £9.** Small 50/1 Ball Bearing Stepdown Gear box, **39/6.**

LEARN THE MORSE CODE
IDEAL FOR BOY SCOUTS
Buzzer complete in wooden case.
12/6

COMPLETE BATTERY CHARGER

Fitted with Brand New English Selenium Rectifier.

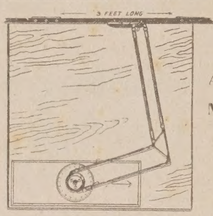
Works off 230v. Household Supply.

Charges any battery, 6 volts at 4 amps, £6/15/- complete. Also available, 6 or 12 volt Charger combined. Charges 4 amps, £7/15/-. 6 volt 6 amp Chargers, complete, £5/15/-; 12 volt 3 amp, £6/15/-; 6 and 12 volt, 6 amp, £9/15/-.

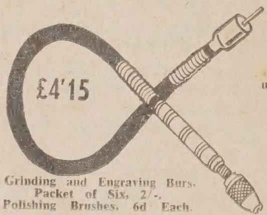
Not secondhand.
BRAND NEW.
ENGLISH G.E.C. RECTIFIERS
Make Yourself a Battery Charger.

12v 2 amp	32/6
6v 5 amp	50/-
12v 3 amp	45/-
6v 2 amp	24/6
6v 4 amp	45/-
12v 5 amp	79/6

Transformers to suit above, 2 amps, 39/6 6 volt, 5 amps, 45/-; 12 volts, 5 amps, 55/-; Transformer to suit dual charger, 6 and 12 volt, 39/6. Rectifier to suit, 45/-.



PLOTTING ARM ONLY
Makes useful Drawing Arm.
37/6



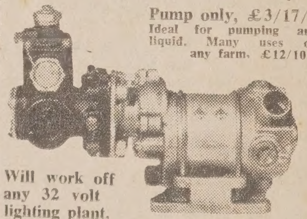
44in long, universal flexible shaft chuck ¼in.

Grinding and Engraving Burs, Packet of Six, 2/-. Polishing Brushes, 6d Each.

For hobbyists, die makers, home handymen, garagemen, engineers, plastic workers.

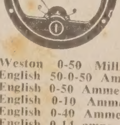
AIRCRAFT 24 volts Motor complete with 400 gal. per hour Pump.

Pump only, £3/17/6
Ideal for pumping any liquid. Many uses on any farm. £12/10/-



Will work off any 32 volt lighting plant.

Special Disposals Meter Offer
All Brand New, British Made



Eng. 0-30 Amps 2¼in DC	32/6
0-3 amp meters, AC-DC, 2¼in dial	45/-
0-1 milliamp 2½in dial	37/6
Weston 0-50 volt 0-100 amps, combined M/coil	£3/10/-
Weston 0-50 Milliamps 2½in	27/6
English 50-0-50 Ammeters M/Coil	37/6
English 0-50 Ammeters, AC-DC	42/-
English 0-10 Ammeters, 2¼in dial M/Coil	45/-
English 0-40 Ammeters, 2¾in dial, AC-DC,	42/-
English 0-14 amps AC-DC 4½in dial	59/6
Eng. 0-20 amps, 2in dial, M/C	25/-
Eng. 0-200 Ammeters, M Coil	£4/10/-
Eng. 20-0-20 Ammeters, M/Coil	37/6
Eng. 0-50 Amps AC-DC 3¾in dial	75/-
Eng. 0-80 Amps, AC-DC, 3¾in dial	75/-
Eng. 0-1 Amps DC 2¼in dial	35/-
Eng. 200 Amps AC-DC 3¼in	£4/19/6
Eng. 0-5 Amps AC-DC 2¼in	45/-
Eng. 0-150 Milliamps 2¼in DC	27/6
Eng. 0-500 Micro amps 3½in DC	50/-
Eng. 0-6 Amps 3¾in DC	25/-
Eng. 0-25 Volts 2¼in DC	22/6
Eng. Ohmmeter reads 0-60 M.Amps 0-500 ohms, 0-15 volts, 0-3 volts 3in dial,	45/-
0-100 milliamps new	17/6
[illegible] 4½ 0/1 milliamp Meter	£5/5

TELESCOPES

NEVER BEFORE AT THESE PRICES
20 Magnifications .. ..
In Pigskin Leather Carrying Case £5/5/-
25 Mag with Tripod **£6/19/6**
To our Customers who have been waiting limited shipment of 50 magnification Prismatic Telescopes on Tripod **£19/19/-**

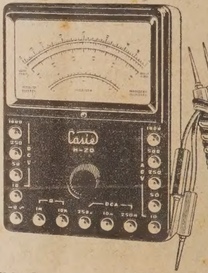
R.A.F. LEATHER FLYING HELMETS, 50/- each.

Intercommunication TUBES 50/-

MK7 Goggles 22/6 Pair
MK8 Goggles 48/6

Polaroid Goggles 48/6.

DALTON COMPUTORS 45/-

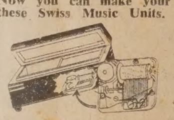


MULTI-METER
£7'10'0

160 Micro-amps sensitivity.
Db Scale —20 plus 3

DC Volts up to 1000, AC volts up to 1000 DC amps, 250 milliamps up to 1 meg ohms.

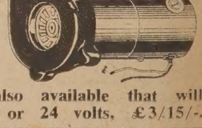
Now you can make your own music box with these Swiss Music Units.



30/-
EACH

Lili Marlene, Harry Lime Theme, Wedding March, Merry Widow, Happy Birthday Anniversary Waltz, Silent Night, Swedish Rhapsody, Annie Laurie, How Dry We Are, Roll Out The Barrel, Teddy Bears Picnic.

English Motor and Blower, 24 volts,
Will work off any Lighting Plant.



39/6

Large size also available that will work off 12 or 24 volts, £3/15/-.

BRAND NEW LEVER TYPE GREASE GUNS WORTH £4/19/6

47/6

Ideal for all types of Trucks. Tractors or Cars. 7500lb pressure.

ANSWERS TO CORRESPONDENTS

:.M.R. (Orange, NSW). It is quite ticable tune to the sound channel of a station using an FM tuner. Whether youl hear N from your location depends onhether ir home site is on a high spot, anhether ı can erect a high, directional ac A nber of amateur stations in youicinity /e been able to receive Sydney statiom the and 144 Mc bands under these ditions, l the only real answer is to try it your-f. A 3-element beam would proba work te well, and the ARRL handbook give ı the design data for working out thement gths. An extremely wide-band aeris not uired for receiving FM sound. may o be able to hear the FM station iydney about 92 Mc, although your beawould bably need remodelling to operate this quency.

'Puzzled" (Moonee Ponds, Vic.). Y diffi-ty is due to the fact that you have umed inductance of the winding is doublwhen ce the number of turns have beeround In fact, it is broadly true to that inductance is multiplied four times doing s, as its value will increase as thquare the turns ratio, and not in direct pretion. r speaker transformer work, you caccept s as a general rule.

S.R. (Hurstville, NSW) is interested ex-iments with home built TV receivers.

A.—Your questions will be largely answd by article which appears in the Decembissue the magazine. We hope to include a nber articles from now on dealing with Tcon-uction.

"Ronald T" (Wollongong, NSW), ask bout difference between the 6AQ5 and the3W6 ves.

A.—The main difference is in the ltage ing for these valves. Because of itsirger se, the 6BW6 has a higher rating th the Q5, which is limited to 250 volts oboth te and screen. Flash-over in the basmay e place with the latter if higher volt is ed. Your best plan would be to look the ires in the data sheets which will tell the ry.

L.C.S. (Camberwell, Victoria) informs that has successfully completed the consttion the "Electronorgan" as described in thoook ed Electronic Musical Instruments, by M. rf, L.C.S. would be pleased to give ders advice in the building of this organ.

A. We are pleased, L.C.S., to hear oyour ccess with the electronic organ. Rders o wish to avail themselves of L.C.S.'offer ould address their correspondence to C. arborough, 4 Waterloo St., CamberwellVic-ia

H.F. (Mosman, NSW), has built a Playmaster, and reports that he is getting hum trouble which is apparent when the volume is turned up, but which doesn't appear to be picked up by the pick-up head.

A.—From the details you give, we strongly suspect you have a multiple earth connection which is providing an earth loop. It is extremely important that the only earth lead for the control unit and the shielded wire from the pick-up is via the connecting cable which runs into the amplifier. Normally the amplifier is earthed via a three-pin power plug. We strongly suspect that if you look carefully at the motor and pick-up which you have, you will find the shielded pick-up lead is earthed to the turntable. As it is likely that you have a separate power cord running to the motor, no doubt another three-pin connection, the double earth will constitute the earth loop to which we have refered.

The cure is to remove the connection between the shielded pick-up lead and the turntable, so that the only earth connection for the braided wire is via the control unit. By all means leave the earth lead to the motor as it is at present. For your information this dual earthing trouble is by no means uncommon with home assembled apparatus, and only recently we came across a case which was an exact parallel with the symptoms you describe.

D.A.S. (Beaumont, SA) asks us to clear a point regarding a VCR138 tube which he purchased. He also refers to the data in an advertisement for this tube, where voltage ratings are given for anodes 2 and 3. D.A.S. would like to know whether the voltages quoted are correct, what voltage to apply to anode one and which anode to connect to the focus control. Further, D.A.S. would like to know whether we have any plans for a future use of a VCR97 tube in a television receiver.

A. Unfortunately, D.A.S., we do not have much data on the VCR138 tube, and must therefore assume the advertiser's specifications to be correct. The voltage ratings given are probably the maximum recommended, but lower voltages may be used if full screen brightness is not required. The rating for anode one is not given, probably because it is intended to return to the focus control. We have considered the use of a VCR97 and 5BP1 in a television receiver and will be able to give you more advice in the New Year. Many thanks, D.A.S., for the appreciative comments about the article on hard-valve time bases.

"RJ" (Roseville) asks some questions about the RJ type of speaker enclosure.

A.—We suggest you read the articles on speaker enclosures which have appeared during issues of the magazine in recent months. Not only was some information about RJ tests included but several suggestions were made which seem applicable to your case.

R.C. (via Young, NSW) wants to know when we are going to describe another battery set for country use.

A.—There is very little incentive to describe battery sets on the scale of some years ago for a number of reasons. Firstly most people in the country now have AC power, and secondly a suitable set would be virtually the same as those now used for portables. A five-valve battery portable would work very well indeed with a large out-door aerial, or even a small one for that matter, although naturally the batteries most suitable would be of the larger type of equal voltage. These will give infinitely greater life than the small batteries generally fitted to portable sets.

We know that some of our readers use 32-volt lighting plants, but they are not very common these days, and it is hard to find space for a full article of this kind for the benefit of a handful. We are not very happy about this position, but there isn't much we can do about it for the time being. Vibrator powered battery sets have almost disappeared from the market today—here again there is a very good substitute in the form of a car receiver, which will work even better as a permanent set in the home than it does in a car because of the larger aerials which can be erected. Our recent Karset would be a good choice here, for it provides a performance almost indistinguishable from an AC set and much better than most small mantels. Naturally larger speakers than usually fitted to portable or to car sets can be used with improved results.

T.S.A. (Florent Park, WA) wishes to know if it is possible to write an article to help those people who are lovers of good music, but who have little technical knowledge and wish to convert their present radiograms to Hi-Fi equipment. Also, whether the reproduction from 10in speakers is as good as from 12in speakers. T.S.A. adds that he has a cabinet which he intends to convert to a vented enclosure, the dimensions being suitable for a 10in speaker, and would like us to recommend a 10in speaker in the £30 range. Further, would we recommend a suitable amplifier and preamplifier.

A. Although we sympathise with your views, we feel that it would be impossible to cover the requirements of every individual by a series of articles.

As for the merits of 10in and 12in speakers, if the specifications for both are the same, our preference would be for the 12in speaker. Rather than purchase a speaker to suit an existing cabinet we suggest that you invest in a 12in speaker and build a cabinet to suit. Available in the price group that you specify, are a number of very good 12in speakers. We suggest that you seek opportunities to hear as many of these as possible and make a selection to suit your taste. The choice of amplifier would depend on the maximum power output that you require. As a suggestion for a low powered unit, the 10 watt U-L amplifier and Control Unit 7 would be excellent. If you wish a high-powered unit, the Control Unit 7 can be mated to the 17 watt U-L amplifier. Both these units would be suitable for use with the Dual player.

G.I.S. (Taggerty, Vic.) submits an idea for connections to the mains plug for a piece of "transformerless" equipment which could be applied to normal AC/DC sets, obviating the need to return earth joints in a set to a busbar and keeping the chassis isolated for power frequencies.

A.—Thank you for your letter, G.I.S. As far as the simple circuiting is concerned it would certainly work. However we cannot imagine that the power authorities would sanction any system which involved drawing the load current through the earth circuit. If this circuit should be become faulty, the device would become a real death trap.

J.M. (Murwillumbah, NSW) asks us to clarify a point concerning the sequence of capacitors in the cut positions of the treble switch in control unit No. 4.

A.—The original circuit of the control unit No. 4, published in June, 1954, contained an error in that the 300 and the .0013 capacitors were interposed. This was corrected in one of the following issues. However, in the modified version of March, 1956, these capacitors were shown in the correct sequence.

J.L. (Bendigo, Vic.) asks for shortwave coil data to suit a small receiver using two battery valves.

A.—A data sheet under the heading Coil Details for Small Receivers is available through the query service. In addition to the number of turns, spacing wire gauges for several shortwave bands the sheet gives information on adjusting the coils for best performance under different conditions.

The Radio, Televisio and Hobbies Query Service

All queries concerning our digns, to which a POSTAL REPLY is required must be accompanied by a postal te or stamps to the value of TWO SHILLINGS.

For the same fee, we will ge advice by mail on radio matters, provided the information can be drawn frn general knowledge. UNDER NO CIRCUMSTANCES, however, can we unirtake to answer problems involving special research, modification to commeral equipment or the preparation of special circuits.

Whatever the subject matter,we must work on the principle that a letter is too involved if the reply takes mre than 10 minutes of our time.

Queries not accompanied by he necessary fee will be answered FREE in the columns of the magazine and pesented in such a way as to be of interest to other readers.

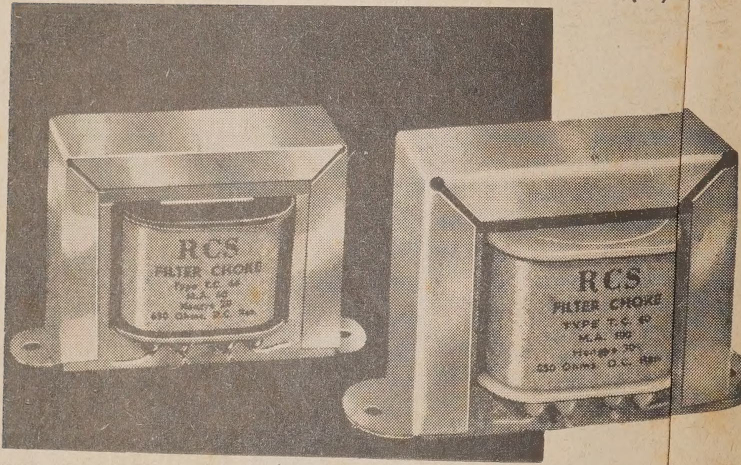
To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lts from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they d NOT show wiring details.

Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

Note that we do not deal in adio components. Price quotations and details of merchandise must be obtained lirect from our advertisers.

R.C.S. release details of . . . CHOKES . . . TRANSFORMRS

Here are full details of types available in R.. filter chokes, audio chokes and transformers, filament and auto nsformers, speaker transformers and speaker replacent windings. It is suggested that these details be kept for referenceThese R.C.S. components are both designed and manufaced in the light of latest findings in the field of electronics. Brackets e of aluminium and bobbins are of moulded polystne.



FILTER CHOKES AND SPEAKER TRANSFORMERS
Size: Core Section ¾in x ¾in 10 watts.
o/all sizes 2¾in L x 2in H x 1¼in W.

CHOKES AND TRAFORMERS
Size: Core Section 7/ x 7/8in 15 watts
o/all sizes 2¾in x 2in H x 1¾in W.

TV COILS

WIND YOUR OWN

COMPLETE COIL ASSEM BLIES COMPRISIN . . . .

TYPE
MO 4 IF ASSEMBLY:
1 Alum. Can
1 4 pin Former
2 Iron Cores

CAN: 7/8in dia. x 1¾in h Fits Noval Socket hole.
FORMER: 8mm threaded Polystyrene
CORES: New 28 TPI HF Cores. Hexagon centre hole. Top and Bottom Cores adjustable from top.

TPE
M 5 RATIO DETECTOR ASSEMBLY:
1 lum. Can
1 pin Former
2 ron Cores

T.V. FILAMENT TRANSFORMERS

FILAMENT TRANSFORMERS:
Type TP 60 2.5v 1.75 amp valves 2X2A—AV11
TP 61 4v 1 amp valves VCR97—511B
TP 62 6.3v .6 amp valves 5BP1—5CP1
TESTED: 5000v between Pri., Sec., and Frame

DIELECTRIC: Ensure maximum stability by coil impregnation with R.C.S. special liquid polystyrene

EHT SUPPLY: Type HF 3K 3000v HF Osc. Coil.
FRAME OUTPUT TRANSFORMER:
Type TP 63
Pri. 7000 ohm 6 BM8
Sec. 10.4 mH.

FITER CHOKES:
Type TC 66A 15H 60MA
TC 60A 3H 300MA

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